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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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THE SCOTTISH GEOGRAPHICAL MAGAZINE

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
PROFESSOR JAMES GEIKIE, LL.D., D.C.L., F.R.S., HON. EDITOR
W. A. TAYLOR, M.A., F.R.S.E., ACTING EDITOR

VOLUME XIII: 1897

EDINBURGH
PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HER MAJESTY
AT THE UNIVERSITY PRESS
1897

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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

SOME OBSERVATIONS ON THE TEMPERATURE OF THE WATER OF THE SCOTTISH FRESH-WATER LOCHS.

By JOHN MURRAY, D.Sc., F.R.S., of the *Challenger* Expedition.

(*With Diagrams.*)

IN the *Journal of the Scottish Meteorological Society* (1887), in the *Scottish Geographical Magazine* (1888), and in the *Proceedings of the Royal Society of Edinburgh* (1891),[1] a large number of temperature observations taken at different depths in the salt- and fresh-water lochs of the west of Scotland were published. These were almost all taken from the steam yacht *Medusa*, by means of Negretti and Zambra's thermometers, the methods of work being fully described in these papers. It is now proposed to publish the observations in subsequent years, limiting the observations in the present paper chiefly to the fresh-water lochs. It seems desirable to place on record these observations, as they are valuable for reference and comparison, especially as it is intended, in conjunction with Mr. F. P. Pullar, to examine during this year the physical conditions of many of the principal lochs of Scotland. A more complete knowledge of the temperature conditions in these fresh-water lochs in different years, at different seasons of the year, and in different states of the weather, would undoubtedly lead to very interesting results. At the present time the observations are so few in number that they do not afford a sufficient basis for any wide generalisations; still, it may be interesting to notice some of the changes indicated by them.

I. TEMPERATURE OBSERVATIONS IN LOCH LOCHY.

In the month of September 1892 the *Medusa* entered Loch Lochy from the south, the preceding days having been fairly good, with moderate

[1] *Journ. Scot. Met. Soc.*, Ser. 3, Nos. iii., iv., 1886-7; *Scot. Geogr. Mag.*, vol. iv. pp. 345-365, 1888; *Proc. Roy. Soc. Edin.*, vol. xviii. pp. 139-228, 1891.

winds. On the succeeding three or four days a south-westerly gale was experienced, and during this time as many observations as possible were taken along the whole length of the loch, at different depths, with the view of showing the effect of the wind on the temperature in the loch.[1]

The observations extended from the 16th to the 23rd September 1892. On Friday the 16th the wind commenced blowing from the south-west about 4 A.M., increasing by midday to a gale, which continued till midnight, when it moderated. On Saturday the 17th the wind at 7 A.M. was still south-west, the force about 2, increasing to fully half a gale by 2 P.M. Throughout Sunday the 18th the strong south-west wind continued, accompanied by heavy rain. The almost continuous rain during these three days raised the level of the loch to the extent of two feet six inches. On Monday the 19th the wind was light and variable all day, veering from the south-west round by the north to the east, but about 9 P.M. it commenced blowing from the ENE., and throughout Tuesday the 20th the wind was chiefly north-east up till 10 P.M., force 2 to 3. On Wednesday the 21st there was a very light air from ENE., with bright sunshine; Thursday the 22nd was calm, misty, with bright sunshine; and on Friday the 23rd there was all day a light wind from the south-west.

The surface temperature of the water ranged from 51·0° to 53·2° F., while the temperature of the air ranged from 48·0° to 56·5°, the water thus being sometimes warmer and sometimes colder than the atmosphere.

The changes which took place in the temperature of the water of the loch during the time of the observations will be better understood by reference to the diagrams accompanying this paper.

Diagram 1 shows the distribution of temperature on the 16th September, and the effect of the wind is very apparent. The heated surface water has been blown towards the upper (northern) end of the loch, a large body of water with a temperature of over 53° F. occupying the upper half of the loch down to a depth of 25 fathoms, and the isotherms all having a downward tendency towards the upper end and an upward tendency towards the lower end of the loch. This seems to show that the pressure of the winds during the south-west gale upon the surface of the loch had produced a sort of tension throughout the whole body of the water, the higher isotherms being pressed downwards towards the northern end, and the lower isotherms, even that of 45° at a depth of 40 fathoms, being drawn upwards towards the surface at the southern end.

Diagram 2 shows the distribution of temperature on the following day, the 17th, when the wind had considerably abated, and it will be observed that the body of water with a temperature of over 53° has shrunk to less than a third of the area it occupied on the previous day, and has sunk below the surface, some of the heat having been dissipated into the atmosphere at the surface, owing to the air being colder than

[1] The observing stations were as follows:—off Laggan locks; ½ mile, 1 mile, and 1½ miles from Laggan locks; 1 mile above Letterfinlay; off Letterfinlay; 1 mile above Invergloy Hotel; off Invergloy Hotel (3 miles from lower lock); off Glenfintaig (2¼ miles from lower lock); round the point towards the Arkaig; foot of Loch Gairlochy; ½ mile from foot of loch; and at the foot of the loch. The stations are indicated in the diagrams by perpendicular lines, and the points of observation by short cross lines.

the water, and some of it into the underlying colder layers of water, as evidenced by the decided downward tendency of the isotherms of 50° and 52° at the upper end. It will be observed also that the area of water from 52° to 53° has largely increased, as well as the area from 50° to 52°, the heat having been derived principally from mixture with the mass of water which on the previous day had a temperature of over 53°. It will be observed, further, that the so-called tension in the waters of the loch was probably not so great as during the height of the gale on the previous day, for the isotherms of 45° and 50° towards the southern end of the loch lie at a lower level than on the 16th. To replace the water blown towards the upper end at the surface, the underlying water is drawn up at the lower (southern) end of the loch, and the isotherm of 52° now cuts the surface near that end. This return current of underlying water does not, however, appear to affect the water to any great depth, for the isotherm of 50° shows as yet no tendency to approach the surface, but has rather sunk very slightly at the lower end of the loch—a remark applying also, and in a greater degree, to the isotherm of 45°, as already indicated; the interchange and mixture of water has been almost entirely confined to the warmer upper waters of the loch, for the reduction of the mass of water with a temperature of over 53° has been compensated by a corresponding increase in the mass of water with a temperature of 50° to 53°. The bulk of the water with a temperature under 50° has been very slightly affected, though the passage of heat downwards is indicated by the fact that the area between 45° and 50° has been increased and the area under 45° diminished to a small extent.

Diagram 3 shows the distribution of temperature on the 19th, no observations having been taken on the 18th, the intervening day, when strong south-westerly winds prevailed; the winds fell away during the night, and throughout the 19th were light and variable. The mass of water with a temperature of over 53° has now been reduced to a very small patch towards the upper end, at a depth of between 10 and 20 fathoms, and the heat has been dissipated principally into the surrounding water, for, the temperature of the air during this day being higher than that of the water, dissipation of heat into the atmosphere would be arrested, and the isotherms of 50° and 52° approach each other rapidly, proceeding towards the upper end of the loch, until they finally coalesce. The isotherm of 52° cuts the surface a little farther to the north than on the 17th. The mass of water with a temperature under 50° remains about the same as on the 17th, but the heating effect has still further increased the mass of water between 45° and 50°, and diminished the mass of water under 45°.

Diagram 4 shows the distribution of temperature on the 20th. The wind having changed to the north-east, the air is colder than the water, and heat has evidently been rapidly dissipated into the atmosphere at the surface, for the temperature of 53° has entirely disappeared from the waters of the loch, and the water with a temperature of over 52° has been much reduced in bulk, the isotherm of 52° cutting the surface much farther north than on the previous day, and lying much nearer the surface throughout its whole course. The mass of water with a tem-

perature of 50° to 52° is much increased, while the water with a temperature of 45° to 50° is diminished in bulk.

Diagram 5 shows the distribution of temperature on the 23rd, two calm days with bright sunshine intervening between the observations represented in Diagrams 4 and 5. The heating effect upon the surface waters is shown by the fact that the isotherm of 52° has sunk entirely below the surface, and now lies almost parallel with the surface at a depth of 15 to 20 fathoms; but the water has not at any point reached the temperature of 53°, which it had at the commencement of the gale. The isotherms of 50° and 52° are now nearly parallel, and the interval between them is much less than on the 20th. The bulk of water between 45° and 50°, it will be observed, has since the commencement of the observations been considerably increased, while the bulk of water with a temperature under 45° has been slightly reduced.

Curves of temperature have been constructed from the temperature observations taken in the same position in the centre of Loch Lochy on the 16th, 17th, 19th, and 23rd September 1892, and are shown in Diagram 6. These curves indicate (1) the fall in the surface temperature on each succeeding day down to a depth of 20 or 25 fathoms; (2) a steep gradient between 20 or 25 fathoms and 30 fathoms, which becomes daily less steep, amounting to

0·67° per fathom on the 16th,
0·55° „ „ 17th,
0·50° „ „ 19th,
0·46° „ „ 23rd;

(3) a slight rise daily in the temperature between 30 and 50 fathoms; while (4) the temperature between 50 fathoms and the bottom remains practically uniform throughout the whole period.

Looking at these observations in Loch Lochy during the week 16th to 23rd September 1892 as a whole, the effect of the gale upon the waters of the loch may be summarised thus:—In the first place, the warm surface waters with a temperature of over 53° are driven before the wind towards the upper end of the loch, being gradually pressed beneath the surface and diminishing in volume until the temperature of 53° entirely disappears, while the heat is dissipated partly into the atmosphere at the surface and partly into the underlying water. The isotherm of 52° follows in the wake of the isotherm of 53°, rising to the surface at the lower end and cutting the surface farther and farther to the north each day; had the gale continued long enough, it is probable that the temperature of 52° would in a short time have disappeared entirely from the waters of the loch in the same manner as the temperature of 53°, but two calm days, with bright sunshine, heated up the surface waters, and the isotherm of 52° resumed its normal position below the surface. The upwelling of the underlying water at the lower end of the loch, to take the place of the surface water driven before the wind, does not appear to affect to any great extent the colder deep waters, for the volume of water with a temperature below 50° remains practically the same throughout the whole period, although, as we have just pointed out, the bulk of water between 45° and 50° has been increased, while

that under 45° has been diminished. On the whole, the deeper waters, those with a temperature below 50°, are being heated by contact and mixture with the warmer layers above, and on the other hand the warmer layers towards the surface are parting with their heat to the overlying atmosphere. The fact that in the first day's observations, during the height of the gale, the water at a temperature of 45° is drawn considerably towards the surface at the lower end and depressed at the upper end, while at other times, as for instance on the 19th, the isotherm of 45° is rather higher at the upper end than at the lower end of the loch, seems to point to considerable oscillations in the whole body of the water. In this loch, however, the return currents to replace the surface water driven before the wind appear to take place relatively near the surface, say between 10 and 20 fathoms, although the mixture due to return currents during these days of observation seems to extend to depths between 25 and 40 fathoms.

II. Temperature Observations in Loch Ness.

On the 21st and 22nd September, 1892, the *Medusa* took observations in Loch Ness, and the temperatures taken on these two days are combined in one diagram (Diagram 7). The irregularities in the position of the isotherms are probably due to the effects of the gale during the preceding three or four days; but as the observations taken on two different days are combined in this diagram, it is rather hazardous to attempt any explanation of the distribution here indicated.

III. Temperature of the Surface Layers in Fresh-water Lochs.[1]

If the temperature at the surface of several of the fresh-water lochs of Scotland be taken at any one time of the year during the summer months, it appears to be almost always the case that the smaller and shallower loch is warmer than the larger and deeper one. This fact is apparently intimately connected with the mixing up of the surface and deeper waters through the action of the wind, as indicated in the previous paragraphs and in the diagrams. For instance, during the past summer, in the month of July, the temperature in the three principal fresh-water lochs of the island of Mull (Frisa, Ba, and Uisg) was taken either on the same day or on succeeding days, and it was found that the surface water of Loch Frisa was 58·3°, Loch Ba 60°, and Loch Uisg 63·2°; and from these relations of temperature in the three different lochs it was confidently expected that Loch Frisa would be found to be deeper than Loch Ba, and Loch Uisg the shallowest of the three lochs. Subsequent careful sound-

[1] In order to draw comparisons between the temperature of the waters of Lochs Ness, Lochy, Oich, Morar, and Etive, tables were prepared for each loch showing the mean temperature at all depths from surface to bottom for each month in which observations have been taken by the *Medusa*, by Mr. Buchanan, by the Fishery Board, and by Messrs. Murray and Pullar. From these tables means were extracted for the surface and bottom waters, taking the surface waters from 0 to 10 fathoms as representing the mean surface temperature, and taking the bottom waters from 20 or 30 fathoms above the bottom down to the bottom as representing the mean bottom temperature. The range of temperature in these surface and bottom waters is taken from the actual observations.

ings throughout the whole areas of the lochs showed, as anticipated, that Loch Frisa was the deepest, having a depth of 200 feet, Loch Ba having a depth of 147 feet, and Loch Uisg a depth of only 23 feet.

Again, in the month of June last, the surface waters of Loch Morar, which has a depth of 180 fathoms, were found to have a temperature of 56·4°, while those of Loch Ba had a temperature of 59°, and those of Loch Uisg 62·5°.

This relation of size and depth to the temperature of fresh-water lochs is certainly true of the lochs in the line of the Caledonian Canal for those months in which observations are available. Of the three lochs, Loch Ness is the largest and deepest, Loch Lochy is much smaller and shallower than Loch Ness, and the very small shallow Loch Oich is situated between the other two larger lochs. In every case where observations are available for comparison in these three lochs in the same month the temperature of the surface waters of Loch Oich down to a depth of 10 fathoms is higher than that of the surface waters of Loch Lochy, which again are warmer than those of Loch Ness. For instance, in September 1887 the temperature of Loch Oich from the surface down to 10 fathoms ranged from 55·4° to 58·5°, the mean being 57·3°; while in Loch Lochy the range was from 52·6° to 56·5°, the mean being 54·9°; and in Loch Ness the range was from 46·0° to 54·8°, the mean being 52·7°. In September 1892 the temperature of the water was lower and the range smaller than in September 1887, but still the same relation held good though not so marked: thus in Loch Oich the range was from 51·2° to 53·3°, the mean being 52·4°; in Loch Lochy the range was from 50·6° to 53·4°, the mean being 52·2°; and in Loch Ness the range was from 50·0° to 53·1°, the mean being 51·6°. In April 1887 the temperature was of course much lower than in September, and the range was very small, still the same relation can be traced; thus in Loch Oich the range was only from 44·0° to 44·2°, the mean being 44·18°; in Loch Lochy the range was from 42·3° to 44·0°, the mean being 43·0°; and in Loch Ness the range was from 41·4° to 43·0°, the mean being 42·2°.

In August of 1879, 1880, and 1881, Mr. Buchanan took a few observations in these three lochs, and, though the temperature differed considerably in these three years, the relation between the temperature of the surface waters and the size of the loch was maintained: thus in August 1879 the waters of Loch Oich down to 10 fathoms ranged in temperature from 55·5° to 57·0°, the mean being 56·1°; in Loch Lochy the range was from 50·95° to 56·0°, the mean being 53·1°; and in Loch Ness the range was from 49·5° to 51·9°, the mean being 50·8°. In August 1880 the range in Loch Oich was from 55·05° to 60·0°, mean 58·2°; in Loch Lochy the range was from 54·0° to 58·0°, mean 56·9°; in Loch Ness the range was from 52·7° to 58·2°, mean 55·2°. In August 1881 the range in Loch Oich was from 56·9° to 57·0°, mean 57·0°; in Loch Lochy the range was from 53·1° to 54·9°, mean 53·9°; in Loch Ness the range was from 50·45° to 53·7°, mean 52·3°.

In August of 1877 and 1878 Mr. Buchanan took observations only in Loch Lochy and Loch Ness, and in each case the surface waters of Loch Lochy were warmer than those of Loch Ness.

Let us now compare in this connection Loch Morar, the deepest of all fresh-water lochs, with these three lochs of the Caledonian Canal. As regards superficial area Loch Morar is comparable with Loch Lochy, but it is more than twice as deep, being in fact half as deep again as Loch Ness, which covers probably double the superficial area. We have contemporaneous observations in these four lochs only in April and September of 1887, which show that in April 1887 the surface waters of Loch Morar down to 10 fathoms had a temperature similar to that of the surface waters of Loch Lochy, the mean being a little higher, viz., 43·3° as compared with 43·0° in Loch Lochy, while in September 1887 the surface waters of Loch Morar had a mean temperature higher even than those of Loch Oich, and much higher than those of either Loch Lochy or Loch Ness, viz., 57·9° as compared with 57·3° in Loch Oich, 54·9° in Loch Lochy, and 52·7° in Loch Ness. Dr. Buchan has suggested to me that this high temperature in the surface waters of Loch Morar in September may be due to radiation from the steep and high hills which surround the loch.

Notwithstanding the exception just pointed out in the case of Loch Morar, it would seem that by temperature observations in the surface waters during the summer months, it is possible to foretell whether a loch is relatively shallow or relatively deep. Further observations are requisite to determine the relative effects of the extent and depth of the loch upon the temperature of the surface waters, and of course the different effects of the direct rays of the sun upon the waters of a shallow and of a deep lake must also be taken into account.

IV. Temperature of the Deeper Layers in Fresh-water Lochs.

The cause of the low temperature in the deep waters of the fresh-water lochs of Scotland has been discussed by Sir Robert Christison, Mr. James Jardine, Mr. Alexander Buchan, Mr. J. Y. Buchanan, and others. Buchan suggests "that it is the mean temperature of the cold half of the year which determines the temperature of the lowest stratum of water at the bottom of deep lakes, so long as the deep-water temperature does not fall below that of the maximum density of the water."[1] Buchanan likewise says that the bottom temperature in lakes depends on the temperature of the previous winter.[2] A study of the deep-water temperature observations in fresh-water lochs appears, however, to point to the effect of the wind as an important factor in determining the temperature of the deeper waters in these lochs, a factor hitherto almost entirely neglected.

In the three lochs of the Caledonian Canal it is observed that, like the surface temperature, the bottom temperature varies with the size of the loch, the bottom waters of Loch Oich being in every recorded instance warmer than those of Loch Lochy, which, again, are warmer than those of Loch Ness. The bottom temperature varies from year to year, but it rises or falls simultaneously in all the three lochs.

The bottom temperatures in Lochs Ness and Lochy, as observed in

[1] *Proc. Roy. Soc. Edin.*, vol. vii. p. 795, 1872.

[2] Article "Lake," *Encycl. Brit.*, ninth edition.

August and September in six different seasons, are given in the following table arranged in order from lowest to highest:—

August and September.	Loch Ness. Mean of all observations in depths over 100 fms.	Loch Lochy. Mean of all observations in depths over 60 fms.
1879	41·2°	42·1°
1878	42·4°	43·8°
1887	42·4°	43·9°
1880	42·5°	43·9°
1877	42·6°	44·0°
1892	42·9°	44·5°

It will thus be observed that the lowest temperatures at the bottom occurred in the year 1879 [1] and the highest in 1892. In the four seasons in which observations were taken in Loch Oich the same order for the bottom temperature is preserved, so that apparently the cause or causes giving rise to the variations in the bottom temperature affect the three lochs in a similar manner. It may be remarked that the lowest recorded bottom temperature in Loch Morar (40·8°) was observed in July 1879, corresponding to the season with lowest temperature in the deep waters of Lochs Ness, Lochy, and Oich, but it is impossible to carry the comparison further for lack of observations in Loch Morar.

The mean temperatures of the air in the vicinity of the Caledonian Canal lochs for the six winter months (November to April), preceding the six autumns in which we have observations of the temperature in the deep waters of Lochs Ness and Lochy, are given in the following table, arranged in order from lowest to highest:—

November to April.	Mean temperature [2] of the air for winter six months (Nov. to April.)
1878-79	34·0°
1891-92	38·2°
1876-77	38·5°
1879-80	39·4°
1886-87	39·5°
1877-78	40·7°

A comparison of this table with the table showing the bottom temperature in Lochs Ness and Lochy shows that the variation in the bottom temperature does not agree with the variation in the mean temperature of the air in the preceding winter. It is true that the lowest bottom temperature was observed in the autumn of 1879 following

[1] The year 1879 was the coldest since 1861.

[2] The temperatures of the air as recorded at Roy Bridge are taken for the years prior to 1880, before observations were commenced at Fort Augustus; for subsequent years the Fort Augustus observations are used.

the coldest winter season (1878-79), which was extraordinarily severe, and is referred to in the sequel. But, with this exception, the tables show that the highest mean winter temperature (40·7° at Roy Bridge) was followed by the lowest mean bottom temperature (42·4° in Loch Ness), and the lowest mean winter temperature (38·2°) was followed by the highest mean bottom temperature (42·9° in Loch Ness). This agrees with Mr. Buchanan's statement, in the article already cited, that, in comparing the bottom temperature in lakes with the mean temperatures of the coldest half of the year, we find that the two approach each other more nearly the higher these [air] temperatures are.

The prevalence of strong winds during the summer months must have a decided influence on the autumn bottom temperature of inland lochs. The stronger and more continuous the winds, the more thorough will be the mixing of the upper and lower strata of water, and the greater the depth to which this mixing will extend. In the summer of 1878, for instance, the force of the wind was below the average for the past forty years, taking the monthly means recorded for the whole of Scotland as our standard, and in the autumn of that year, as already stated, the mean winter temperature and the bottom temperature in the lochs of the Caledonian Canal approached each other more nearly than on any other recorded occasion. Again, in the summers of 1877 and 1892 the force of the wind was much above the average, and in the autumns of these years we have high bottom temperatures in the lochs following winters with comparatively low mean temperatures, as though a thorough mixing of the waters had taken place and a high temperature had been propagated downwards. In the summer of 1880 the force of the wind was very little above the average, and in that season a medium bottom temperature followed a medium mean winter temperature. In the summer of 1879 the force of the wind was rather above the average, following on an abnormally rigorous winter with a continuous low temperature,[1] and in the autumn of that year a very low bottom temperature was observed in the lochs of the Caledonian Canal, as well as in Loch Morar, as though the bottom water had not recovered from the thorough cooling to which the whole mass of water had been subjected during the previous winter.

It would be very interesting to have temperature observations in the waters of these lochs during the winter months, especially in very cold weather, when the temperature of the surface water would be below the maximum density point. With the surface water in this condition it is very probable that during strong gales large quantities of water below the maximum density point would be forced down into the deeper layers, in the same way as we have seen warm water above 53° forced beneath the surface, as shown in Diagrams 2 and 3.

It is interesting to notice that while the surface and bottom temperatures are higher in a smaller than in a larger loch, the temperature of the intermediate waters in a large loch appears as a general rule to be

[1] The mean monthly temperatures as observed at Roy Bridge during the six winter months of 1878-9 are:—November, 35·4°; December, 26·7°; January, 30·6°; February, 34·1°; March, 36·4°; April, 40·6.

higher than that of the intermediate waters in a small loch in the autumn, judging from the observations we have in the Caledonian Canal lochs. In all the autumn observations the mean temperature in Loch Ness, from about 15 to 40 or 50 fathoms, was higher than at corresponding depths in Loch Lochy; thus in August 1877 Loch Ness was warmer than Loch Lochy between 15 and 50 fathoms, in August 1878 between 15 and 35 fathoms, in August 1879 between 20 and 40 fathoms, in August 1880 between 20 and 30 fathoms, in September 1887 between 20 and 40 fathoms, and in September 1892 between 25 and 45 fathoms. Loch Oich is so shallow as to be of little service in comparisons between observations taken in intermediate waters; still, the only two observations in 15 fathoms available may be referred to in this connection: thus in August 1879 Loch Oich was colder at 15 fathoms than both Lochs Ness and Lochy, while in August 1880 it was slightly warmer than Loch Ness and colder than Loch Lochy at 15 fathoms.

V. Loch Etive.

Loch Etive is a salt-water loch into which the sea-water rushes over a ledge with great force at high water, and out of which at low water a raging torrent flows in the opposite direction at the Falls of Lora. For the sake of comparison we may refer to the temperature observations taken in this sea-water loch, in which, as might be expected, the distribution of temperature presents but little correspondence with the distribution in fresh-water lochs, due to the properties of sea-water.

Diagram 8 shows the distribution of temperature in Loch Etive on the 28th September 1892. On the 26th a strong wind blew from the SSW., and on the 28th the wind was light from the south-west, with squalls at the head of the loch. Here the warm water (over 52°) is seen to be sandwiched between colder water at the surface and at the bottom, the uppermost isotherm of 52° falling from the surface at the mouth to a depth of 5 fathoms at the head of the loch, and the lowermost isotherm of 52° lying at a depth of about 15 fathoms in the inner deep basin, while warm water fills the whole of the outer shallow basin.

In the month of September 1887 the surface waters of Loch Etive had a temperature similar to that of the waters of Loch Lochy, the mean being a little higher, viz., 55·5°, while in September 1892 the surface waters of Loch Etive down to 10 fathoms had a mean temperature higher than in any of these Caledonian Canal lochs, even Loch Oich; the range was, however, much larger in Loch Etive, and the temperature increased gradually from the surface down to 10 fathoms, while in the lochs of the Caledonian Canal the temperature was pretty much the same from the surface down to 10 fathoms, so that if we limit our comparisons to the water down to 5 fathoms, the mean temperature in Loch Etive would be found to be lower than that of the water down to 5 fathoms in any of the three Caledonian Canal lochs.

I wish to acknowledge my indebtedness to Mr. John D. Murray and Captain Alexander Turbyne for their assistance in taking the temperature observations recorded in this paper, and to Mr. James Chumley for assistance in preparing these observations for publication.

1892.	LOCH LOCHY.						
Date	Sept. 16	Sept. 16	Sept. 16	Sept. 16	Sept. 16	Sept. 16	Sept. 16
Position	Off Laggan Locks	1 mile from Laggan Locks (off Killiannan)	1½ miles from Laggan Locks	A little NE. of Letterfinlay	Little NE. of Invergloy Hotel	Little NE. of Glenfintaig, Auchnacarry	Foot of Loch Gairlochy, off 1st red buoy
Hour	10.50	11.10	11.30	12.5	13.10	14.5	14.55
Wind	SW. gale (4-5)	SW. gale (5-6)	SW. gale (5-6)	SW. gale (5-6 in gusts)	SW. gale (6-7)	SW. gale (4-5)	SW. gale (5 or 6)
Weather and Sea	Showers, gusts, rough	Rain, squalls, very rough	Rain, squalls, rough	Rain, squalls, very rough	Rain, squalls, rough	Rain, squalls, rough	Rain, squalls, smooth
Depth	5	9	19	41	73	51	4
Temp. of Air	54·0	54·0	53·1	52·9	49·8 (wet)	49·9 (wet)	49·0 (wet)
Fathoms.							
0	52·2	53·2	53·2	53·1	52·9	52·9	52·1
1	...	...	...	...	...	...	52·1
2	52·0	...	53·3	...	...	...	...
3	...	53·2	...	...	...	...	52·2
4	52·2	...	...	...	...	...	
5		..	53·4	53·2	52·8	52·9	...
6	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...
8	...	53·4	53·2	...	...	...	...
9	...		...	...	...	...	...
10	...	...	...	53·3	53·0	52·7	...
12	...	...	53·2*	...	...	...	...
14	...	...	...	53·1*	...	49·2*	...
16	...	..	...	...	...	...	...
18	...	...	53·4	...	...	..	...
20	...	...		53·2	52·9	46·7	...
22	...	...	...	...	...	...	...
24	...	...	...	53·2*	...	45·5*	...
26	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...
30	...	...	...	52·5	46·2	44·9	...
32	...	...	..	...	...	...	...
34	...	...	...	48·5*	...	...	...
36	...	...	...	...	...	...	..
38	...	...	...	...	..	...	...
40	..	...	...	46·7	45·1	44·5	...
42	...	...	...		...	...	...
44	...	...	...	...	...	...	..
46	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...
50	...	...	...	...	...	44·5	...
52	...	...	...	...	44·6		..
54	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	..	...	44·4	...	...
64	...	..	...	...	...	...	...
66	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	...	...	...	...	44·4	..	...
74	...	...	...	...		...	...
76	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...
80	..	...	...	...	...	...	...
82	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.						
Date	Sept. 16	Sept. 16	Sept. 17	Sept. 17	Sept. 17	Sept. 17	Sept. 17
Position	½ mile from foot of loch, beyond 2nd red buoy	Round point towards the Arkaig	Round point towards the Arkaig	½ mile from foot of loch	Foot of loch, off 1st red buoy	NE. of Glenfintaig	Little NE. of Invergloy Hotel
Hour	15.10	15.30	8.45	9.5	9.30	10.0	10.50
Wind	SW. gale (5 or 6)	SW. gale (5 or 6)	SW., 1	SW., 1	SW., 2	SW., 2	SW., 2
Weather and Sea	Rain, squalls, roughish	Rain, squalls, roughish	Cloudy, bright at times, smooth	Cloudy, smooth	Cloudy, dull, smooth	Overcast, rain, ripple	Sunshine, showers, ripple
Depth	26	16	16	26	4	52	73
Temp. of Air	49·0 (wet)	48·0 (wet)	48·6	49·0	49·0	48·6	48·8
Fathoms.							
0	52·1	52·2	52·3	52·0	51·8	52·7	52·5
1	...	...	...	...	51·7	...	...
2	...	...	...	...	...	...	...
3	...	...	...	...	51·9	...	...
4	...	...	...	...		...	...
5	52·1	52·1	52·1	52·0	...	52·2	52·5
6	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...
10	50·6	...	...	51·8	...	52·2	52·8
12	...	...	...	...	...	...	...
14	50·1*	50·0*	52·1*	51·3*	...	51·7*	...
16	...			...	...	...	...
18	...	...	...	...	...	...	...
20	49·0	...	...	48·3	...	51·3	52·0
22	...	...	...	...	...	...	...
24	49·0*	...	...	47·0*	...	48·7*	...
26		...	...		...	...	...
28	...	...	...	...	...	...	...
30	...	...	...	...	...	46·3*	46·5
32	..	...	...	...	...	...	...
34	...	...	...	...	...	...	...
36	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...
40	...	...	...	...	...	45·2*	45·2
42	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...
50	...	...	...	...	...	44·8*	...
52	...	...	...	...	...		44·8
54	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	...	...	...	...	44·4
64	...	...	...	...	...	...	...
66	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	...	...	...	...	...	...	44·5
74	...	...	...	...	...	...	
76	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...
82	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.						
Date	Sept. 17	Sept. 17	Sept. 17	Sept. 17	Sept. 17	Sept. 19	Sept. 19
Position	Little NE. of Letterfinlay	1½ miles from Laggan Locks	1 mile from Laggan Locks	Off Laggan Locks	NE. of Letterfinlay	Round point towards the Arkaig	½ mile from foot of loch, off 2nd red buoy
Hour	11.45	12.20	12.45	13.0	13.50	7.45	8.7
Wind	SW., 3	SW., 3-4	SW., 3-4	SW., 2	SW., 3	SW., 1	SW., 2
Weather and Sea	Rain showers, roughish	Rain showers, rough	Showers, squalls, rough	Overcast, smooth	Rain, squalls, rough	Cloudy, rain, smooth	Dull, smooth
Depth	39	25	9	5	46	16	26
Temp. of Air	51·6	51·2	...	...	51·2	55·3	54·8
Fathoms.							
0	52·9	53·0	53·0	51·0	52·9	52·2	51·8
1	...	...	...	51·0	...	...	...
2	...	...	...	...	...	...	...
3	...	...	52·9	...	...	...	...
4	...	52·9	...	51·0	...	...	...
5	52·9	...	...		...	51·9	51·7
6	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...
8	...	...	53·1	...	...	...	...
9	...	...		...	...	...	...
10	53·0	53·0	...	...	52·8	...	51·6
12	...	...	...	...	...	...	...
14	53·0*	52·9	...	...	...	51·5*	51·3*
16	...	...	...	...	...		...
18	53·0	...	...	...	...	...	...
20	...	52·7	...	...	53·0	...	49·0
22	...	...	...	...	...	...	...
24	52·9*	53·1	...	...	52·2*	...	47·3*
26	...		...	...	...	...	
28	52·8	...	...	...	...	...	...
30	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...
34	51·1*	...	...	...	48·6*	...	...
36	...	...	...	...	...	...	...
38	48·0	...	...	...	...	...	...
40		...	...	...	...	...	...
42	...	...	...	...	...	...	...
44	...	...	...	...	44·7*	...	...
46	...	...	...	...		...	...
48	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
52	...	...	...	...	...	...	...
54	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...
66	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	...	...	...	...	...	...	...
74	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...
82	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.						
Date	Sept. 19	Sept. 19	Sept.	Sept. 19	Sept. 19	Sept. 19	Sept. 19
Position	Foot of loch, off 1st red buoy	NE. of Glenfintaig	Little NE. of Invergloy Hotel	1 mile NE. of Invergloy Hotel	Little below Letterfinlay	Little above Letterfinlay	1 mile above Letterfinlay
Hour	8.30	8.55	10.10	11.0	12.0	12.50	14.0
Wind	SW., 2	SW., 2	SW., 2	SW., 2	SW., 2	W., 2	SW., 0-1
Weather and Sea	Cloudy, smooth	Rain, smooth	Dull, rain, ripple	Clear, ripple	Dull, rain, ripple	Clear, ripple,	Bright sunshine, ripple
Depth	4	51	73	76	72	43	33
Temp. of Air	56·5	53·8	52·0	55·5	53·8	55·2	56·5
Fathoms.							
0	51·7	52·0	52·3	52·5	52·8	52·8	53·0
1	51·6	...	...	...	...	...	...
2	...	...	52·4	52·5	...	...	52·9
3	51·7	...	...	...	...	52·7	...
4		...	...	...	...	...	...
5	...	...	52·6	52·8	52· 5	...	52·7
6	...	...	...	...	...	...	...
7	...	...	...	...	...	52·6	...
8	...	...	...	52·5	...	...	52·7
9	...	...	...	...	...	...	...
10	...	51·9	52·2	...	52·5	...	52·7
12	...	...	...	...	...	...	52·8
14	...	...	52·2*	52·3*	52·4*	...	52·5*
16	...	...	...	...	...	52·5*	...
18	...	...	...	52·3	...	...	52·5
20	...	51·2	52·0	...	52·5	...	...
22	...	...	...	...	...	52·7	52·6
23	...	...	...	...	...	...	52·4
24	...	...	...	...	...	...	52·5
25	...	...	51·8	51·4	52·2	52·3 52·0	46·3
26	...	...	...	...	...	50·5	...
27	...	...	...	...	...	47·9 47·8	...
28	...	...	...	48·3	52·0	...	45·4
29	...	...	...	...	47·3	...	...
30	...	47·4	47·0	46·9	47·3 47·0	...	...
31	...	...	...	...	46·6	...	...
32	...	...	...	...	...	46·2	45·1
34	...	...	...	46·1*	...	...	
36	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...
40	...	45·0	45·3	45·2	45·3	...	...
42	...	...	...	...	...	45·0	...
46	...	...	...	...	...		...
50	...	44·9	...	45·0	44·9*	...	..
52	...		44·8	...	...	...	...
54	...	...	...	44·8*	...	...	...
56	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	44·5*	...	...
62	...	...	44·5	...	...	...	...
64	...	...	...	44·4*	...	...	...
66		...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	44·6*	...	...
72	...	...	44·5	...		...	...
74	...	...		44·5*	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.							
Date . .	Sept. 19	Sept. 19	Sept. 19	Sept. 19	Sept. 19	Sept. 20	Sept. 20	Sept. 20
Position .	1½ miles from Laggan Locks	1 mile from Laggan Locks, off Killiannan	½ mile from Laggan Locks	SW. of Invergloy, 3 miles from lower lock	NE. of Glenfintaig, 2¼ miles from lower lock	NE. of Glenfintaig	1 mile above Letterfinlay	1 mile from Laggan Locks
Hour . .	15.0	15.15	15.25	16.25	17.10	9.5	11.25	12.0
Wind . .	NNE., 0-1	NW., 0-1	WSW., 0-1	N., 0-1	N., 1	E., 2	NE., 1-2	NE.,
Weather and Sea	Cloudy, ripple	Cloudy, ripple	Cloudy, ripple,	Dull, smooth	Cloudy, ripple	Bright, cloudy, ripple	Overcast, ripple	Overcast, ripple
Depth	19	9	7	77	52	51	32	9
Temp. of Air	54·0	53·4	52·9	52·0	51·0	49·0	51·0	50·4
Fathoms.								
0	52·9	52·9	51·5	52·2	52·0	51·9	52·9	52·6
1	...		...	...	...	...	...	...
2	...		...	...	...	...	...	...
3	...	52·8	51·4	...	...	...	...	52·5
4	52·8	...	...	...	...	...	...	...
5	...	...	...	52·2	...	51·9	52·5	...
6	...	...	51·5	...	...	...	...	...
7	...	...		...	...	...	...	...
8	52·6	53·0	...	...	52·1	...	...	52·8
9	...		...	...	...	...	...	
10	52·6	...	...	...	...	52·0	52·5*	...
12	...	...	...	...	...	...	...	...
14	53·0*	...	...	52·0*	51·9*	51·9*	51·9*	...
16	...	...	...	...	...	...	...	...
18	53·0	...	...	...	...	...	...	...
20		...	...	52·0	...	...	50·7*	...
22	...	...	...	...	...	...	...	...
24	...	...	...	51·1*	50·3*	51·8*	50·0*	...
26	...	...	...	...	...	...	...	...
28	...	...	...	49·3	50·1	...	49·0	...
29	...	...	...	...	49·3	...	...	...
30	...	...	...	47·9	49·2	51·6	48·3*	...
31	...	...	...	...	48·1 47·6	...		...
32	...	...	...	...	...	...	...	...
34	...	...	...	...	...	...	...	...
35	...	...	...	46·5	46·3	45·8	...	...
36	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...
40	...	...	.	45·4	45·1*	45·0	...	...
42	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...
46	...	...	...	..	...	...	...	...
48	...	...	...	...	..	...	...	...
50	...	...	...	...	44·9*	44·7	...	...
52	...	...	...	...			...	...
54	...	...	...	...	...	...	...	...
56	...	...	...	44·6	...	...	...	...
58	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...	...
66	...	...	...	44·4	...	...	...	...
68	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
72	...	...	..	...	...	...	...	...
74	...	...	...	...	...	...	...	...
76	...	...	...	44·5	...	...	...	...
78	...	...	...		...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH NESS.							
Date	Sept. 21	Sept. 21	Sept. 21	Sept. 21	Sept. 22	Sept. 22	Sept. 22	Sept. 22
Position	1 mile from Fort Augustus	Off Dochfour House	Off Aldourie	Off Tor Point	NE. ¾ m. Urquhart Castle	Off Foyers, near Aultsaye	Off Monastery, Fort Augustus	1 mile from Fort Augustus
Hour	9.15	17.20	17.40	18.5	9.15	11.15	13.50	14.40
Wind	SW., 0	Calm	ENE. air	ENE. air, 0-1	SW., 1-2	SW., 0-1	E., 1	Calm
Weather and Sea	Bright, clear, smooth	Bright, blue sky, smooth	Sunshine, smooth	Sunshine, smooth	Sunshine, fog clearing away, smooth	Sunshine and fog, smooth	Sunshine, clear, ripple	Sunshine, smooth
Depth	83	5	19	56	118	111	49	83
Temp. of Air	41·0	50·0	50·5	50·9	43·3	42·7 (in fog)	52·3	54·0
Fathoms.								
0	51·0	52·0	52·4	52·3	51·7	51·9	51·8	53·1
1	...	...	...	...	...	...	...	...
2	...	52·2	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...
4	...	52·3	...	...	...	...	...	...
5	50·7		51·5	...	51·7	51·4	51·2	51·2
6	...	...	...	...	..	...	...	...
8	...	...	51·2	...	...	...	...	...
10	51·0	...	50·0	50·3	51·6	51·4	51·1	51·2
14	50·7*	...	49·1*	...	...	50·8*	...	51·1*
18	...	...	48·7	...	...	...	...	...
20	...	...		49·3	51·7	...	51·1	...
24	...	...	...	...	...	...	...	...
25	50·7	...	...	...	51·3	49·8	...	50·8
26	...	...	...	...	50·8	...	...	...
27	...	...	...	...	49·1	...	...	...
28	...	...	...	...	47·8	...	50·7	...
29	...	...	...	...	47·1	...	...	...
30	51·2	...	...	...	46·7	49·3	...	50·5
32	...	...	...	...	...	47·1	...	...
33	...	...	...	...	...	46·9	50·4	...
34	...	...	...	...	...	47·0	50·5	...
35	49·2	...	...	48·0	46·1	46·2]	...	50·3
36	...	...	...	...	...	...	48·2	50·2
37	...	...	...	...	...	...	...	49·9
38	...	..	...	...	...	...	47·9	49·0
40	46·5	...	...	...	45·7	44·1	...	47·4
42	...	...	...	...	...	...	45·0*	...
44	...	...	...	47·2*	...	...	44·0*	...
48	...	...	..	...	...	...	43·6	...
50	44·2	...	...	...	45·5	44·0		43·5
54	...	...	...	...	44·5	...	...	...
55	...	...	...	47·0	44·3	...	...	...
56	...	...	...		44·3	...	...	...
60	...	...	...	...	43·7	43·2	...	...
62	43·2	...	...	...	...	...	...	43·1
66	...	...	...	...	...	...	...	...
70	...	...	...	...	43·2	43·1	...	...
72	43·0	...	...	...	...	...	...	42·9
76	...	...	...	...	...	...	...	...
80	...	...	...	...	43·2	43·1	...	...
82	43·0	...	...	...	...	...	...	43·0
90		...	...	...	...	43·1	...	
97	...	...	...	...	43·0	...	...	...
100	...	...	...	...	...	42·9	...	...
101	...	...	..	...	...	...	...	...
107	...	...	...	...	42·9	...	...	...
110	...	...	...	...	...	43·0	...	...
117	...	...	...	...	42·7		.	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH OICH.			LOCH LOCHY.			
Date	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23
Position	¼ mile from bridge at lower end	Off Invergorry	¾ mile from bridge at upper end	½ mile from Laggan Locks	1 mile from Laggan Locks	1½ miles from Laggan Locks	1 mile above Letterfinlay
Hour	8.20	8.40	9.0	10.5	10.10	10.30	10.45
Wind	SW., 1-2	SW., 1	SW., 1	SW., 2	SW., 2	SW., 2	SW., 2
Weather and Sea	Bright, clear, ripple	Sunshine, clear, smooth	Dull, smooth	Overcast, ripple	Overcast, ripple	Overcast, ripple	Overcast, ripple
Depth	21	4	11	5	9	19	33
Temp. of Air	42·9	42·9	42·0	52·0	51·0	51·0	50·5
Fathoms.							
0	51·6	51·2	53·0	51·2	52·2	52·1	52·0
1	...	52·1	...	51·2	...	...	...
2	...	...	...	...	...	...	...
3	...	52·5	...	...	52·2	...	...
4	...		...	50·8	...	52·1	...
5	...	...	53·0		...	...	52·0
6	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...
8	...	...	...	...	52·4	52·1	52·0
9	...	...	...	..		...	...
10	51·6	...	53·3	...	...	52·0	...
12	...	...		...	...	...	52·2
14	...	...	...	...	...	52·1*	51·2*
16	...	...	...	...	...	...	...
18	...	...	...	...	...	52·1	...
20	51·9	...	...	...	...		...
22		...	...	...	...	...	51·8
24	...	...	...	...	...	...	51·7*
26	...	...	...	...	...	...	...
28	...	...	...	...	...	...	49·2
30	...	...	...	...	...	...	47·8
32	...	...	...	...	...	...	47·0
34	...	...	...	...	...	...	
36	...	...	...	...	...	...	..
38	...	...	...	...	...	..	...
40	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...
44	...	...	.	...	...	...	..
46	...	...	...	...	...	...	..
48	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
52	...	...	...	...	...	...	...
54	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...
64	...	...	...	.	...	...	...
66	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	..	...	...	...	...
72	...	...	...	...	...	...	...
74	...	...	...	...	...	...	...
76	..	...	...	...	...	...	...
78	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...
82	...	..	...	...	...	...	...
84	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.						
Date	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23	Sept. 23
Position	Little above Letterfinlay	Little below Letterfinlay	1 mile N. of Invergloy Hotel	NE. of Invergloy Hotel	SW. of Invergloy, 3 m. from lower lock	NE. of Glenfintaig	Round point towards the Arkaig
Hour	11.40	...	13.15	14.30	15.5	15.50	17.30
Wind	SW., 2	SW., 1	SW., 0-1	SW., 0-1	SW., 1	SW., 0	SW., 0-1
Weather and Sea	Overcast, ripple	Overcast, dull, ripple	Mist, smooth	Overcast, smooth	Overcast, dull, smooth	Overcast, dull, smooth	Mist, smooth
Depth	44	74	76	76	77	51	16
Temp. of Air	50·3	49·5	49·5	51·2	51·9	53·4	55·4
Fathoms.							
0	52·0	52·0	52·1	52·1	52·0	52·2	52·1
1	...	...	...	...	...	...	...
2	...	...	..	...	...	...	...
3	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...
5	...	...	52·2	52·1	52·1	52·2	52·2
6	...	...	...	...	...	...	...
7	52·0	...	...	...	...	...	...
8	...	52·0	52·3	...	...	...	...
9	...	...	...	...	...	...	...
10	...	...	...	52·1	...	52·4	...
12	...	...	...	...	...	...	...
14	...	...	...	...	51·9*	52·0*	52·4*
16	52·0*	...	...	...	...	...	
18	...	51·9	52·0	...	...	...	...
20	...	51·8	...	51·8	51·7	...	...
22	51·5*	...	...	...	...	...	...
24	...	52·0	51·0*	50·7*	50·2*	50·5*	...
26	51·2	50·8	...	...	...	...	...
28	49·0	48·6	49·2	49·0	48·7	...	...
30	47·7	47·1	47·2	47·2	47·1	46·8	...
32	47·2*	...	...	...	...	...	...
34	46·4*	...	46·1*	...	45·7*	45·6*	...
36	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...
40	...	45·5	45·5	45·3	45·2	44·7	...
42	45·5*	...	...	...	...	...	...
44		...	...	...	...	...	...
46	...	...	...	...	..	...	...
48	...	...	...	...	...	...	...
50	...	...	...	...	...	44·7	...
52	...	45·0*	...	...	...		...
54	...	...	44·9*	44·7*	...	...	...
56	...	...	...	...	44·8	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	44·4*	..	...	...	...	...
64	...	...	44·5*	44·4*	...	...	...
66	...	...	...	...	44·5	..	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	...	44·6*	...	..	...	...	...
74	...		44·5*	44·5*	...	..	...
76	...	...			44·6	...	...
78	...	...	...	...		..	..
80	...	...	...	...	...	...	...
82	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH LOCHY.		LOCH ETIVE.				
Date	Sept. 23	Sept. 23	Sept. 26	Sept. 28	Sept. 28	Sept. 28	Sept. 28
Position	½ mile from foot of loch, off 2nd red buoy	Foot of loch, off 1st red buoy	Off Ru Aird	¾ m. above mail ferry	Off Ru Aird	Off Ardmaddy Farm	Off Inbhir-guisachan
Hour	17.45	18.0	15.35	8.30	9.20	10.30	11.20
Wind	SW., 0-1	SW., 0-1	SSW., 5-6	S., 0-1	WSW., 1-3	SW., 2	WSW., 0-1
Weather and Sea	Overcast, cloudy, smooth	Overcast, dull, smooth,	Overcast, rain, rough	Overcast, smooth	Overcast, rain, ripple	Cloudy, sunshine, ripple	Cloudy, rain, smooth
Depth	26	4	77	51	76	49	15
Temp. of Air	...	55·4	54·7	48·0	44·9	48·0	47·0
Fathoms.							
0	52·0	52·0	51·4	51·3	49·8	49·0	48·8
1	...	52·1	...	...	...	...	...
2	...	...	51·4	...	50·7	49·6	50·0
3	...	52·2	...	51·7	...	...	51·2
4	...		53·2	...	...	52·0	52·6
5	52·0	...	54·0	52·9	53·8	...	...
6	...	...	...	...	...	53·7	54·0
7	...	...	...	...	...	...	...
8	..	...	...	...	...	54·2	...
9	...	...	...	...	...	...	54·6
10	52·1	...	54·7	54·2	54·5	54·6	...
12	...	...	53·3	53·5*	53·9	53·4	53·0
14	52·1*	...	52·0 51·5*	51·5*	52·9	52·0*	51·7
16	...	...	51·2	51·0*	52·0	...	
18	...	...	50·1 49·3*	50·1	50·6 50·3*	50·1	...
20	48·6	...	48·8	49·0	49·3	49·8	...
22	...	...	...	...	...	...	...
24	47·3*	...	48·0*	...	47·7*	...	...
26		...	...	...	...	...	...
28	...	...	...	...	..	48·4	...
30	...	...	47·7	47·5	48·0	...	...
32	...	...	...	...	...	...	...
34	...	...	...	...	47·8*	...	...
36	...	...	...	...	..	...	...
38	...	...	...	...	...	48·2	...
40	...	...	48·0	47·9	...	...	...
42	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...
48	...	...	...	...	...	48·3	...
50	...	...	...	48·3	...		...
52	...	...	...		...	...	...
54	...	...	...	...	48·2	...	...
56	...	...	48·3	...	...	...	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...
66	...	...	48·3	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	...	...	...	...	...	...	...
74	...	...	...	...	48·8*	...	...
76	...	...	48·6	...		...	...
78	...	...		...	...	...	...
80	...	...	Wind from SSW., strong squalls.	...	...	...	...
82	...	...		...	...	...	...

* Observation made 1 fathom deeper than indicated.

1892.	LOCH ETIVE.						
Date	Sept. 28	Sept. 28	Sept. 28	Sept. 28	Sept. 28	Sept. 28	Sept. 28
Position	Head	Off Ru Aird Trileadham	Little above Cadderlie Farm	Off Eilu Durains	Opposite Aird's Park	Opposite Ardchattan Church	Opposite Cable post
Hour	12.10	12.45	13.45	15.0	15.30	16.30	16.55
Wind	SW., 1-7 (squalls)	SW., 2	WSW., 2	SW., 1	SW., 0-1	W., 2-3	W., 1
Weather and Sea	Cloudy, rain, ripple	Cloudy, ripple	Cloudy, rain, ripple	Bright sunshine, smooth	Cloudy, bright, smooth	Cloudy, ripple	Cloudy, smooth
Depth	13	19	55	11	30	33	7
Temp. of Air	47·0	48·2	47·0	49·0	49·5	47·5	47·8
Fathoms.							
0	46·8	48·2	49·4	51·4	51·7	51·8	52·0
1	...	...	...	...	...	...	...
2	46·9	48·7	...	51·4	...	52·3	...
3	47·0	49·2	51·0	...	...	...	52·4
4	50·2	51·0	...	...	...	...	...
5	52·8	53·0	53·2	52·5	53·2	52·9	...
6	...	...	...	53·8	...	...	52·9
7	53·2	...	...	...	...	...	
8	53·3	54·5	54·2	54·1	...	...	...
9	...	...	...	...	53·8	...	...
10	54·5	54·2 53·5*	54·8	54·2	...	53·2	...
12	54·2	52·8 51·8*	54·9		...	53·3	...
14		...	...	...	...	...	...
15	...	51·6	52·2	...	54·0	53·7	...
16	...	...	...	...	...	...	...
18	...	50·0	...	...	54·6	...	...
20	...		49·2	...	..	...	...
22	...	...	...	...	...	53·5	...
24	...	...	...	...	55·3*	...	...
26	...	...	...	...	...	...	...
28	...	...	...	...	55·3*	...	...
30	...	...	48·2	...		...	...
32	...	...	...	...	...	54·1	...
34	...	...	48·0	...	...		...
36	...	..	...	...	...	...	...
38	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...
42	...	...	...	...	...	...	...
44	...	...	48·1	...	..	...	...
46	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
52	...	...	...	...	...	...	...
54	...	...	48·4	...	...	...	...
56	...	...		...	...	..	...
58	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...
66	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...
72	..	...	...	...	...	...	...
74	...	...	...	...	..	...	...
76	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...
80	..	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

1896.	LOCH MORAR.		LOCH BA (MULL).		LOCH FRISA (MULL).	LOCH UISG (MULL).		LOCH AWE.
Date . .	May 11	June 25 & 26	June 11	July 14	July 15	June 22	July 15	July 20
Position .	Off Sron Mhor							Off Inver-stronach
Hour . .	17.25	9.15		17.40	12.0		17.20	
Wind . .					Strong wind		2	
Weather and Sea				Overcast	Overcast		Sunshine	
Depth . Temp. of Air								
Fathoms.								
0	51·7	57·0 / 56·4	59·0	60·0	58·3	62·5 / 62·2	63·2	61·2
1	51·6	56·0	...	60·0	...	...	62·2	...
2	51·4	...	...	...	..	61·8	...	61·3
2½	...	...	...	...	...	61·9	...	...
3	...	...	...	...	...	...	63·2	...
3½	...	...	...	...	...	...	62·5 / 63·1	...
4	...	...	...	...	...	62·0	...	...
5	...	55·0	56·0	59·8	58·0			...
6	...	...	...	...	..	...	...	60·3
7	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...
9	...	...	...	...	...	..	...	...
10	44·75	53·2	...	58·0	55·4	...	...	...
12	..	...	...	...	...	...	...	..
14	...	...	...	55·5*	49·4*	...	...	...
16	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...
20	...	44·5	50·5	51·7	...	...	...	..
22	..	...		51·5	48·6*	..	...	...
24	...	...	...		...	..	...	...
26	...	...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...
30	...	43·3	...	...	...	...	...	...
32	...	...	...	...	48·6*	...	...	...
34	...	...	...	...		...	...	...
36	...	...	...	...	...	...	...	...
38	...	...	...	...	...	...	...	...
40	42·2	42·5	...	...	...	...	...	...
42		...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
52	...	..	...	...	...	...	...	...
54	...	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...	..
58	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
62	...	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...	...
66	...	..	...	...	...	...	...	...
68	...	...	...	...	...	...	...	...
70	...	42·5	...	..	...	...	...	...
72	...		...	...	...	...	...	...
74	...	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...	...

* Observation made 1 fathom deeper than indicated.

OBITUARY: 1896.

General James T. Walker, R.E., C.B., F.R.S., LL.D.—Although many distinguished men have held the high office of Surveyor-General of India, none possessed more happily combined the practical skill and theoretical knowledge that were brought to bear on the varied duties of that office by General J. T. Walker, whose death on 16th February last has been deplored by those who had been led to appreciate his services in the sphere of geography and his attainments in the department of science. He was honoured and highly respected for his devotion to duty and for his powers of administration by the officers who served under him in the Survey of India. Nor should his military services in the second Punjab Campaign, on the north-west frontier of India, and during the Sepoy Mutiny, be overlooked, for which he received three war medals, with four clasps, and the Companionship of the Bath. He was a Fellow of the Royal Society; and the degree of LL.D. was conferred upon him by the University of Cambridge.

James Thomas Walker, born in 1826, received his professional education at the H.E.I. Company's Military Seminary at Addiscombe, from which he obtained a Commission in the Bombay Engineers. He landed in Bombay in May 1846. Lieutenant Walker was a Field Engineer at the second siege of Multan in 1849; he was present at the battle of Gujerat also in 1849, and joined in the subsequent pursuit of the Sikh army. From 1849 to 1853 he was engaged on a military reconnaissance of the Trans-Indus region, from Peshawur to Dera Ismail Khan, while the tribes of the newly annexed territory were barely under subjection, and work with military expeditions and surveying had to go on together. In December 1853 he joined the Great Trigonometrical Survey under Sir Andrew Waugh, and, after being employed on the measurement of the Chach base-line, near Attock, was given charge of the northern section of the Indus triangulation series. While he was thus engaged, the Sepoy Mutiny of 1857 broke out, and he was soon ordered to join the camp before Delhi. He was there severely wounded, and was afterwards attacked by cholera. On his return to his surveying duties, he resumed work on the Indus series, and subsequently was employed on another series in the Punjab triangulation. During 1860, he was again on the north-west frontier with a military expedition against the Mahsud Waziris. In March 1861, Major Walker (he had been promoted to Captain in 1857, and to Major by brevet for services in the field in 1858) succeeded Sir A. Waugh as Superintendent of the Great Trigonometrical Survey. His first independent work was the measurement of the Vizagapatam base, which was accomplished in 1862; and, during the subsequent twenty-one years of his connection with the department, all the principal triangulation according to the original design of the Survey throughout British India (exclusive of Burma and Baluchistan since undertaken) was brought to completion. In 1864, Walker attained the rank of Lieutenant-Colonel, and in 1869 to that of full Colonel. His subsequent promotions were to Major-General in 1878, to Lieutenant-General in 1881, and to General in 1883.

In January 1878, he was appointed Surveyor-General of India, while the post of Superintendent of the Great Trigonometrical Survey was also retained by him.

Although, as the triangulation progressed, provisional computations were simultaneously carried on, it had always been kept in mind that, on the completion of all the series, a great work of final recomputation would have to be undertaken. The problem was, after all was done, to introduce such adjustments that the discordant results obtained in the computations, if worked through different series of the network of triangles, might be eliminated, so that the whole might harmonise. By what system the desired results were attained need not be shown; suffice it to say, that the procedure prescribed by General Walker, involving the employment of high mathematics, has carried the work to a successful termination, the operation being regarded as a geodetic work of equal importance to the original design of the triangulation, or to the laborious field execution carried on through the greater part of the present century. General Walker inaugurated a further contribution to geodesy by arranging a system of astronomical observations for latitude at selected trigonometrical stations, combined with determinations of differences in their longitudes obtained by means of the electric telegraph. A large number of these latitudes and differential longitudes, have been examined in their relation to the trigonometrical differences, and made use of in one of the latest investigations regarding the figure of the earth, thus serving the purpose for which they were intended. He was determined to omit nothing which would add to the value and usefulness of the operations he controlled; and science is further indebted to him for the initiation of the pendulum operations, whereby the deflection of the force of gravity was determined in different parts of the peninsula of India, a matter of especial scientific interest on account of the hitherto unknown effect on this force of the preponderating influence of the mass of the Himalayan mountains.

The initiation of a scheme of tidal observatories at different ports on the coast, adopted by the Government of India, is also due to General Walker, who elaborated the system and devised the method of analysing the observations. In connection with the tidal observations, he organised an extensive scheme of spirit-levelling, consisting of long lines, some of which extend across the Continent and connect the tidal stations, partly with the view of ascertaining whether there is any appreciable difference of sea-level at different places, and partly with the object of referring to a common datum the detached levels of many engineering works throughout the country. The *Account of the Operations of the Great Trigonometrical Survey*, in twenty volumes, will furnish a permanent memorial of his industry, as well as of his particularly lucid style of writing. The first volume, containing an account of the early operations of the Survey and of the standards of measure and of the base-lines; most of the second volume, describing the method of procedure and instruments employed; and the fifth volume, giving an account of the pendulum operations, are from his own pen. Nine volumes were published under his supervision.

Beyond the limits of India, Walker first became known as a geographer by his map of Turkistan, which, passing through many editions, was the leading authority for twenty years. With regard to this map, it is interesting to mention that materials from Russian sources were incorporated in it, which were supplied to Walker by Russian geographers, with whom he established friendly relations, when in 1864, while on leave, he visited St. Petersburg. He did much to further the system of obtaining geographical information through the agency of trained native explorers in countries outside India, where European surveyors cannot enter; and on the geography of Tibet, which is an especially exclusive country, he was a recognised authority.

After retirement in 1883, General Walker continued to devote much attention to geographical questions, and for ten years he was a most active and valued member of the Council of the Royal Geographical Society. He was President of the Geographical Section of the meeting of the British Association at Aberdeen in 1885; and he took the lead in the geodetical discussions of the International Geographical Congress, held in London in 1895.—J. S.

Gerhard Rohlfs, the celebrated German African explorer, passed away on June 2, 1896, at Rüngsdorf, near Bonn. He belonged to the old generation of travellers, and his loss we mourn. Very much of our knowledge of North-West Africa is due to him, and his name will be remembered when many another associated with African exploration will have been forgotten.

Rohlfs was born in 1831 (not 1832, as appears in some of our contemporaries) at Vegesack, on April 14. He was educated at the Osnabrück Gymnasium, and his university career was passed at Würzburg, Göttingen, and Heidelberg, where he studied medicine, following the footsteps of his father, Gottfried Heinrich Rohlfs, who was a surgeon. At an early age he showed a love of adventure, and he acted as a volunteer in the Schleswig-Holstein war in 1849-50, gaining officer's rank at the battle of Telstedt. Thereafter, not finding an opening for his talents, and probably influenced by the roving character of the sailors who formed the majority of the inhabitants of his birthplace, he, after travelling in Austria, Switzerland, and Italy, in 1855 enlisted in the Foreign Legion in Algiers; and, after the conquest of Great Kabylia, was made sergeant, the highest rank a foreigner could attain, and received several decorations. He became a proficient Arabic scholar, and studied the habits of the people so well that he was able, disguised as a Moslem, to explore as far south as Tuat; then, after visiting Fez and Morocco, he reached Tafilet. He was attacked and left for dead near the Boanon oasis, but was found by two friendly Marabuts, and recovered, with a shortened arm and a stiff little finger. An account of this journey is found in *Adventures in Morocco*, 1874.

In 1863 he tried to reach Timbuktu, but had to retreat to Oran; still, not disheartened, he proceeded to Tangiers, crossed the Atlas, again reached Tafilet, and travelled *viâ* Ghadames to Tripoli. In 1865 he went to Kuka in Bornu, and then on to the Benue *viâ* Yakubu, reach-

ing Lagos in June 1867, after passing through Rabba and the Yoruba country.

Abyssinia was next visited by Rohlfs in 1867-68, then the rock churches of Lalibala and Sokota, and then he journeyed from Tripolis *viâ* Cyrenaica, Aujila, and Siwa to Alexandria.

He returned to Germany after this journey, settling at Weimar, where he married Miss Leonsine Behrens of Riga, a niece of Schweinfurth's. The Gross-Herzog of Weimar made him an "Hofrat," the University of Jena an honorary doctor. At this time he commenced a series of lectures upon his travels, in which he was most successful. He had a fine presence, and was a telling lecturer; indeed, it was said of him that he could make his fortune as a popular lecturer. He was always a welcome guest at geographical and other societies.

In 1873-74 he explored the Libyan Desert with much success. He then had a rest for four years, broken only by a lecturing tour in the United States. In 1878, accompanied by Dr. Stecker, he tried to reach Wadai, but was stopped at Kufra, and had to retreat to Benghazi.

Returning to Europe, he was next sent by the German Emperor to Abyssinia with presents to King John.

Rohlfs was made German Consul at Zanzibar in 1885, but he only held office for a few months.

Such is a rapid outline of the nine journeys Gerhard Rohlfs made in Africa. Apart from the knowledge of the country through which he passed, we have gained much anthropological and archæological information from his labours. He was a keen observer, and his numerous books are an example of what accounts of exploration should be. He took no astronomical observations, his route-maps being made with watch and compass. He was a friend to all African explorers, and ever ready with advice to those who sought him out.

His remains were cremated at Hamburg, and his ashes rest in his birthplace, to which he has left his medals—amongst these the Patrons' Medal of the Royal Geographical Society given him in 1868—his large library, and the large correspondence from African explorers which he so highly prized.—R. W. F.

Otto Ehlers, a very considerable German traveller, was born at Hamburg in 1855. He studied law and agriculture at Jena, Heidelberg, and Bonn, and for some time farmed an estate of his own in Pomerania. A desire for change and reasons of health took him to Italy and Egypt, and thence to German East Africa, where he spent some time at Moshi, near Kilima-Njaro, whence he carried presents from the native Sultan to Berlin, and returned with a similar mission from the Kaiser. He afterwards made extensive journeys through India, Burmah, Siam, and Indo-China, which he recorded in his *An Indischen Fürstenhöfen* and *Im Sattel durch Indo-China*, both popular works. He was much impressed with the desirableness of introducing the Indian elephant into Africa, and exerted himself greatly in the matter, though his labours were, unfortunately, unproductive of result. In August 1895, being in New Guinea, he organised an expedition to cross the island from Huon Gulf to the Gulf of Papua.

Accordingly, with a European companion and forty-four natives, he started from Bayern bay along the Francisco river, hoping to descend by the valley of the Heath river on the British side. The expedition is said to have met with great hardships, and to have been wrecked while crossing the Heath river on a raft, Ehlers and his companion and some twenty-four natives being lost. The survivors afterwards appeared at Port Moresby. Ehlers was personally popular, an acute observer, with considerable descriptive powers, but not strictly a scientific traveller.

Lieutenant E. D. Young, R.N.—Another link with Livingstone was severed when Lieutenant Young died at Hastings on November 4, 1896, at the age of fifty-five.

Edward D. Young was born October 23, 1831. Educated at Greenwich, he entered the Royal Navy as a boy, and worked his way up to the position of gunner of the *Gordon*, serving in East African waters. He was a keen slave-dhow hunter, and a successful one withal. In the early part of 1862 he was selected to command the *Pioneer* on the Zambezi and Shiré rivers under Dr. Livingstone, which post he held till March 1864, when he returned home. In May 1867 he commanded the Livingstone Search Expedition, when he took out a steel boat in sections and conveyed it overland to Nyassa. He was successful in proving that the report of Dr. Livingstone's murder was incorrect. On his return he published *The Search for Livingstone: A Diary kept during the Investigation of his reported Murder*, revised by the Rev. Horace Waller (1868). From that time—1868 to 1875—he was a divisional officer of coastguard, but in the latter year he was given two years' leave in order to conduct the Church of Scotland mission to Lake Nyassa. He did this duty well, taking out a steamer in sections, putting her on the lake, and exploring it thoroughly. He discovered the Livingstone range of mountains, 14,000 feet high, and founded the well-known Livingstonia settlement there.

Returning home, he published an account of this work under the title of *Nyassa: A Journal of Adventure whilst exploring Lake Nyassa, Central Africa, and establishing the Settlement of Livingstonia*, revised by the Rev. Horace Waller (1877).

Young then returned to his coastguard duties, retiring in June 1891 with the rank of honorary lieutenant by an order of Council dated July 30, 1891.

Although not an explorer of first rank, Lieutenant Young did good service for Africa, and his name deserves to be on the roll of those who have worked for African civilisation.—R. W. F.

The Rev. Horace Waller.—At East Liss, Hampshire, the Rev. Horace Waller, so well known as an African philanthropist and anti-slavery speaker and writer, died, at the age of sixty-three, of pneumonia, on 22nd February 1896. Mr. Waller, as he then was, went to East Africa in 1861 as a layman in connection with the first expedition of the Universities Mission, which was founded by Dr. Livingstone. He worked under Bishop Mackenzie, but was associated for some time with

Dr. Livingstone and Sir John Kirk in exploring the Zambezi and Shiré districts. His knowledge of business, which he acquired during his early years in London, made him a valuable acquisition, both in mission and in exploring work. He combined with this valuable quality those of a good observer and an ardent sportsman, whilst he possessed a manly, lovable nature, and his sympathy with the downtrodden Africans was keen and lifelong.

After Bishop Mackenzie's death, the subject of our notice returned to England, took holy orders, joined the Anti-Slavery Society, and commenced with ardour to carry on anti-slavery work, which he continued until the end. He is well known for his editing Dr. Livingstone's Journals, which were published in 1875. In addition to this, he wrote numerous pamphlets of a semi-political nature, dealing with Africa and the slave-trade. As a British delegate, he attended the Anti-Slavery Congress held in Paris in 1867, and, in conjunction with Mr. Edmund Sturge, he was instrumental in obtaining for Dr. John Kirk, as he then was, the appointment of permanent political agent at Zanzibar. He was an impressive speaker, and took part in many anti-slavery demonstrations in various parts of the country, and the writer of this notice well remembers his vigorous and fiery denunciation of that inhuman trade. Mr. Waller was first a curate at Chatham, where he became a friend of the late General Gordon; he was then for four years vicar of Leytonstone; and from 1874 to 1895 he was rector of Twywell, in Northamptonshire.—R. W. F.

Dr. J. A. Moloney.—Another African traveller has passed away, namely, Dr. Moloney, who died on the 5th October 1896. The son of the late Captain Moloney of the 60th Rifles, he was born at Newry, in Ireland, in 1858. He studied medicine at St. Thomas's Hospital, London, and took his degree at Dublin University. He first went to Africa with the late Captain Stairs in the expedition to Katanga on behalf of the Congo Free State. He had to bring the expedition back to the coast, owing to Captain Stairs' illness and the death of Captain Bodson. The account of the hardships he then suffered will be found in his book, *With Captain Stairs to Katanga*, which we favourably reviewed when it appeared in 1893.

Dr. Moloney went to the country west of Lake Nyassa in 1895, and induced several native chiefs to place themselves under British protection. His death was due to the hardships he underwent in Africa, and we regret that a life of such promise is thus early cut short.—R. W. F.

Dr. Robert Brown.—A well-known author and litterateur passed away at Streatham on the 26th October 1895, when Dr. Robert Brown departed this life. Born at Campster, in Caithness, in 1842, he was educated at Coldstream, and then at Edinburgh, where he took his M.A. He thereafter studied medicine in Edinburgh, and then proceeded to the Universities of Leyden, Copenhagen, and Rostock. At the last University he took the degree of Ph.D. His first scientific work was in Spitzbergen, Greenland, and Baffin's Bay, to which places he proceeded

on board a whaler, as surgeon, in 1861. 1864 found him botanist to the British Columbia expedition, and later on he was commander of the Vancouver Island exploring party, and he revisited Greenland with Edward Whymper. He was next appointed Lecturer on Geology, Zoology, and Botany at the Watt Institution, in Edinburgh, and at the Mechanics' Institute, Glasgow. He was first president of the Edinburgh Field Naturalist Club, and president of the Royal Physical Society in 1872, and was secretary from 1874 to 1876 to the same Society. He was a prolific writer, and published numerous papers on geology, zoology, and botany, but he will probably be best known by his popular scientific compilations, and especially by the publication of *The Story of Africa and its Explorers*, which has been reviewed from time to time in our *Magazine*.—R. W. F.

William Francis Ainsworth, who died at Hammersmith on November 27th, having just completed his ninetieth year, was in early life closely connected with Edinburgh. He took his medical degree in this city in 1827, filled the office of president of the Royal Physical Society, and in 1829 started the *Edinburgh Journal of Natural and Geographical Science*.

He was a frequent contributor to the magazines of articles on medical and geological subjects, but his most important labours were connected with the Euphrates valley and the adjoining regions. In 1835 he accompanied the expedition under Colonel Chesney as surgeon and geologist, and in 1838 he made known the results of his journey in a book entitled *Researches in Assyria, Babylonia, and Chaldea*. Another work, in two volumes, was the record of a later expedition under the auspices of the Royal Geographical Society and the Society for Promoting Christian Knowledge. During these expeditions he found an opportunity of collecting the material for his most important contribution to geographical knowledge, *Travels in the Track of the Ten Thousand*, published in 1844, wherein he describes the route of the Greeks after the battle of Cunaxa, with the advantage of a personal knowledge of the topography of the country.

Having settled in London in 1841, Mr. Ainsworth devoted himself to literary work up to an advanced age, and always took a great interest in the Euphrates and Tigris valleys, especially as a route to India. His earlier works belong almost to the literature of the last generation, while his latest. *Personal Narrative of the Euphrates Expedition* and *The River Karun: An Opening to British Commerce*, the former published in 1888 and the latter in 1890, have made his name familiar to readers of the present day.

Sir Joseph Prestwich.—The life which closed at Shoreham, Kent, on June 24th, covered a long and important period in the history of geology. Born at Clapham in 1812, Sir Joseph Prestwich had attained the ripe age of eighty-four, and for nearly sixty-four years had been a contributor to geological literature, his first paper having appeared in the *Transactions* of the Geological Society when he was only twenty

years old. A large part of his life was spent in business, and only in 1874 he became a professional geologist, being then appointed to the Professorship of Geology at Oxford, a post from which he retired in 1888.

His name was intimately connected with the work of rearranging the Tertiary series, and in continuing his researches he became convinced of the great antiquity of man, from an examination of flint implements in the Quaternary deposits. In his last work, *Collected Papers on some Controverted Questions of Geology*, he considerably restricted the period he allowed for man's existence, though still dating back his appearance on the earth to a very remote epoch. He was as a rule cautious, and to many of the geologists of the present day seemed sometimes rather backward in accepting the truth of new theories.

He was the author of a large number of papers on geology and subjects connected with it, and was a member of the Royal Coal Commission in 1866, and of the Royal Commission on Metropolitan Water Supply in 1867. His chief literary work was two volumes on *Geology*, published in 1868 and 1888, which fulfilled the high expectations that were formed of it.

Sir Joseph Prestwich received the Wollaston Medal of the Geological Society in 1849, and the Royal Medal from the Royal Society in 1865, and in 1885 he was elected a corresponding member of the Paris Academy of Sciences. Last year the honour of knighthood was conferred on him.

Dr. J. J. Egli.—On August 24th the Swiss Professor, Dr. Egli, died at Zürich, where he had held a Professorship of Geography in the University since 1872. He was born at Uhwiesen-Laufen in May 1825, and had thus attained the age of seventy-one. His special subject was place-names; and his great work, *Nomina Geographica*, first published in 1872, and in a revised and enlarged edition, containing over 70,000 names, in 1892, made his name known to all geographers in Europe. For many years he contributed the section on *Die Fortschritte der Geographischen Namenkunde* to the *Geographisches Jahrbuch*, published by Justus Perthes of Gotha, and he was also the author of geographical text-books and smaller publications. Dr. Egli was a corresponding member of this Society for many years.

Baron Ferdinand von Mueller.—Ferdinand von Mueller, Baron of the kingdom of Würtemberg, Knight of the Order of St. Michael and St. George, Knight Commander of the Order of St. Iago of Portugal and of Isabella of Spain, M.D., Ph.D., F.R.S., etc., was born at Rostock, in Germany, in 1825. As a boy he showed a strong liking for botany, and was educated for the medical profession. Considerations of health led him to emigrate in 1847 to Adelaide, where he at once began to study the Australian flora. In 1852 he was appointed Government botanist of Victoria. In this capacity he made many important botanical expeditions, and was one of the first to ascend the Australian Alps. His great energy and

industry were expressed in voluminous writings, in practical work connected with exploration and naturalisation, and in conducting an immense scientific correspondence. His name will always be associated with the Australian gum-tree (*Eucalyptus*), not so much, perhaps, because of his monograph on the genus, but because he recognised its valuable hygienic properties as a counteractive of malaria. On his advice the tree was planted in many malarial regions, and with the best results.

Among his works may be noted *Fragmenta Phytographiæ Australiæ* (eleven volumes, 1858-1881); *Eucalyptographia* (1879-1884); *Iconography of Australian Species of Acacia* (1887-1888); *Select Plants Eligible for Industrial Culture or Naturalisation in Victoria* (1876); and *Select Extra-tropical Plants Readily Eligible for Industrial Culture*, of which the ninth edition appeared last year. He also gave invaluable assistance to Mr. Bentham in preparing the general *Flora of Australia*.

Baron von Mueller was widely esteemed not only for the merits of his scientific and practical work, but for the generosity with which he spent both himself and his money in the cause of science. By his death Australia has lost a loyal citizen, and botany one of the most illustrious workers. He died in Melbourne, after a short illness, on the morning of October 10th.—J. A. T.

Sir Charles Umpherston Aitchison, K.C.S.I., C.I.E., LL.D. Edin., Hon. M.A. Oxon. By the death of Sir Charles Aitchison, who died at Oxford on 18th February last, the country has lost an administrator and a statesman, who might still have been looked to, had health and longer life been granted to him, for filling with his ripened judgment a further sphere of usefulness in the service of the State, although he had rendered noble service in high positions in India, finishing his career there as a member of the Supreme Council, after holding an equally honoured position as ruler of a Province. As Foreign Secretary to the Government of India, as Administrator of the Provinces of Burma and of the Punjab, he had necessarily much to do with the furtherance of the work of geographers and surveyors, both within the British boundaries and beyond them, so that a tribute to his memory as an influential official may fittingly be paid by this Society. Also, as a distinguished Scotchman and as a townsman of Edinburgh, where he received his education, the pages of this magazine may be opened with equal readiness to pay respect to his abilities and to honour his high character.

Born in Edinburgh in 1832, he was trained at the High School and at the University, where he took his M.A. degree. In 1855, after a short course of study in Germany, he elected to compete for an appointment in the Civil Service of India, which was that year thrown open to public competition. Aitchison came out at the head of the list at the first of the open examinations. In September 1856 he landed at Calcutta, where, as was then the rule, he remained to study Indian law and history and the native languages. On passing in three languages after seven months, he was, on the eve of the Sepoy Mutiny in 1857, posted first in the North-West Provinces, and very soon after-

wards was transferred to the Punjab. For two years, Sir John Lawrence being Lieutenant-Governor, he remained in the Punjab, when he was able to prepare a *Manual of the Criminal Law of the Punjab*, while carrying on at the same time his regular duties. In 1859 he was appointed Foreign Under-Secretary by Lord Canning, to whom, and to the members of Council, he soon commended himself by the clear and forcible writing of the "Notes," which he drew up on the cases submitted for decision. He was employed to reorganise the staff of the Foreign Office, then somewhat confused through recent administrative changes, and the system he introduced still continues. It was at this time he compiled his work in seven volumes of *Treaties, Engagements, and Sanads relating to India and the Neighbouring Countries*, to each section of which valuable historical and juridical notes were prefixed.

After returning for a time to the Punjab, and serving as Deputy Commissioner, Commissioner, and Secretary to Government, he was recalled to the Foreign Office by Sir John Lawrence, then Viceroy, and appointed Secretary. As Foreign Secretary he was for the next eight years the trusted adviser of the successive Viceroys, Lord Mayo and Lord Northbrook, who, following Sir John Lawrence, continued a similar foreign policy. When the policy, more especially toward Afghanistan, was changed during the Viceroyalty of Lord Lytton, Aitchison was on furlough.

In March 1878 he became Chief Commissioner of British Burma, where he remained until 1880, when, his health having failed, he was obliged to proceed to England. During his administration the cadastral survey of British Burma was inaugurated on the Indian system of combining a scientific measurement of each cultivator's field with a record of the class of the land and a register of the name of the cultivator. The operation was much favoured by Aitchison for the means it afforded of levying an equitable land-tax, and of preserving to the cultivators and to their families their occupancy rights. In March 1882 he was appointed Lieutenant-Governor of the Punjab, which office he held for the full term of five years. He then took another rest in England, but soon returned, to become for a short time a member of the Supreme Council. Again his health failed, and he left India finally in 1888. In the important position of Lieutenant-Governor of the Punjab Aitchison exercised great personal influence, gained by his sympathetic regard for native rights, and by his knowledge of the feelings of the people generally and of those of the influential classes. His relations with the officers serving under him were also of the best. His whole administration was, in truth, to every class a moral and intellectual force—morally on the chiefs, through the confidence invoked by private friendship; and intellectually on the priestly classes, both Hindu and Mohammedan, by leading them to study Western science and literature, to promote which he conceived the creation of the Punjab University. He maintained a jealous supervision on all revisions of the land-tax assessments, being animated by sympathy with the people, and recognising the extreme care necessary in the introduction of new demands, which tend to provoke discontent and to check the advance of social prosperity. The Aitchison College at Lahore for the

instruction of the sons of the chiefs, and the Lady Aitchison Hospital for Women, are the visible and beneficent memorials of his administration.

His "Lord Lawrence" in the *Rulers of India* series, published in 1892, was a fitting work for his retirement. It enabled him to bear noble testimony to the statesmanship of his great chief, and it remains a valuable memorial of his own literary talents.—J. S.

The Rev. W. Wyatt Gill, B.A., LL.D., who died at Sydney in November, worked for many years as a missionary in the Hervey Group, first at Mangaia, and afterwards at Rarotonga. A keen interest in the people under his charge led him to study their customs, beliefs, history and traditions, and his writings on these subjects, contained chiefly in his *Myths and Songs from the South Pacific*, *Jottings from the Pacific*, and *From Darkness to Light in Polynesia*, are of great value and interest to the student of folklore. His books (as *Life in the Southern Isles*) also contain many curious notes on points of natural history. To the *Journal* of the Polynesian Society, and to the Australasian Association for the advancement of Science he also contributed papers of value. The last printed revision of the Bible in Rarotongan was his work.

Dr. Gill was a patriotic upholder of British rights in the Pacific, and unwearied in exposing any action which he considered an infringement of them.

"THE EXPLORATION OF THE CAUCASUS."[1]

The pioneer of mountaineering in the Central Caucasus has published in two handsome volumes a description of the range between Elbruz and Kazbek, with narratives of mountain ascents and travels in various parts of the range, and in Abkhasia. A few chapters are contributed by other travellers—Messrs. H. W. Holder, J. C. Cockin, Hermann Woolley, and Maurice de Déchy.

The first chapter deals with the "Discoverers of the Caucasus," and after a brief enumeration of notices of the Caucasus in past times, records more fully the achievements of climbers, who, since the ascent of Elbruz and Kazbek in 1868 by the author, accompanied by Mr. Tucker and Mr. A. W. Moore, C.B., have conquered the chief summits of the range; scientific travellers are also alluded to.

Mr. Freshfield insists more than once on the service rendered by mountaineers in preparing the way for the scientific traveller, and the value of views from commanding summits as a basis for scientific reasoning. As illustrative of scenery in the Caucasus, we may quote from his description of the prospect unfolded from Kazbek, Elbruz, or other principal peaks:—

"The heaven overhead is of a deep gentian blue; the neighbouring snows are dazzling white; as the range recedes the peaks shine golden, until on the horizon

[1] *The Exploration of the Caucasus*, by Douglas W. Freshfield. 2 vols. London, 1896.

the farthest crests and the thin streaks of cloud take a rich amber tint, shading off into faint sunrise pinks. A luminous, opalescent, transparent haze spreads over the lowlands, softening but hardly obscuring their features. About our solitary pinnacle all is still and silent, save for the lapping of the little waves of warm air that rise up to us from the valleys, the far-off and indistinct, but perpetual murmur of falling torrents, and the momentary roar of avalanches as they plunge from the frozen cliffs of *névé* underfoot into the hidden depths of the glaciers. The vast blue landscape, some 500 miles in diameter, outspread beneath, is spanned by a broad belt of snowy heights and hollows, as the sky is arched at night by the Milky Way. These heights do not show as the single wall indicated on maps, but rather as a system of short crests, running generally at an acute angle to the direction of the chain, and more nearly due east and west. We can distinguish generally two (sometimes more) principal ridges roughly parallel. The peaks are encased in frosty armour, full of subtle lines and delicate flutings, where the corniced crests throw their bands of shadow on to the broad breastplate of snow. Below the *Bergschrund*, or fissure that belts the mountain sides, heavy folds of stainless *névé* fall to the lower glaciers. Where the crags are bare they show the boldness and rigidity of outline characteristic of the harder crystalline rocks. In the central group, round Shkara, Koshantau and Dykhtau, the forces, whatever they were, that gave the chain its being, seem to have been most strenuously exerted ; the crests are higher, the slopes steeper, the trenches more profound. There is a vigour, an extravagance, one might say, in the mountain structure that may recall the Alps of Dauphiné.

"The hollows between the heights are filled by enormous firths of ice, whose basins stretch out parallel to the crests, snowfield beyond snowfield, on a scale hardly found in the Alps except at the bases of the Jungfrau and Finsteraarhorn. From the 'dusky doors' of the glaciers rivers flash full grown into life, and our eyes follow their course in either direction, north or south, as they linger for a time in broad forest basins or grassy trenches at the foot of the snows, and gather their tributaries before battling a way out through deep ravines and a maze of foothills to the distant steppe or the dim surface of the Black Sea."

The structure of the mountains in relation to its scenery is then discussed, and details of the length and area of the glaciers are given. At present the total area of glaciation is not exactly known, but calculations from the best material available show that an estimate of 625 to 650 square miles cannot be far from the truth. In connection with these, Mr. Freshfield refers to the absence of lakes as a fact that "must be faced by those who believe that the great prehistoric glaciers excavated lake-basins," though he does not hold that it is conclusive evidence for or against the glacial origin of mountain lakes. While, however, there are no sheets of water sufficiently large to deserve the name of lakes, and comparatively few pools, yet the latter are not altogether wanting. M. Rossikof has investigated those in the central part of the northern slope of the Caucasus—among them the Amkachi, in the Chechen country, 500 or 600 yards long, and 4500 feet above sea-level—and found them in general to be rapidly decreasing, while some are already dried up. It is quite possible, then, that more thorough examination may reveal the former existence of more numerous and more extensive sheets of water.

This absence of lakes is one of the chief defects in the scenery of the Caucasus. "It offers nothing to compare to the highly decorated loveli-

ness of Como, the stately charm of Garda and Maggiore, or the pastoral romance of Lucerne and Thun." And, again, "The landscapes on the flanks of the Alps are full of cheerful trivial human incident; those of the Caucasus are less adorned and varied." Nevertheless, the Caucasus has a beauty of its own. "Caucasian scenery belongs to the romantic school. It produces impressions rather by broad effects than by crowded details. Compared with the mountains, the forests and flowers of Suanetia, the alps and pinewoods and chalet-dotted meadows of Grindelwald look stiff and tame; even the great Italian valleys yield in sublimity."

In the chapters in which are narrated the ascents of individual mountains, or the exploration of some particular valleys, the author and his collaborators record many interesting observations, not only of the physical features, but also of the flora, the fauna, and the manners and customs of the numerous Caucasian tribes. Some of these excursions have already been described in the *Proceedings* of the Royal Geographical Society or the *Alpine Journal*. All the chapters are interesting, and it is difficult to select any one for particular notice.

The appendixes contain useful topographical notes, meteorological observations, heights of the lower extremities of the glaciers, and a sketch of "The Physical History of the Caucasus," by Professor Bonney. The volumes are further enriched by a geological map of the Caucasus, founded on the map of the Russian Geological Survey and the work of Abich and Favre, an excellent map of the Central Caucasus from the 5-verst Russian map, panoramas, etc. But the most striking accessories are the illustrations, excellently reproduced from photographs, most of which were taken by Sr. Sella. Both the photographers and the engravers must have done their work well to produce such beautiful results. The printers and bookbinders also have contributed their part to render these volumes a perfect *édition de luxe*.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting held on December 22nd, the following ladies and gentlemen were elected Members of the Society:—

Andrews, Mrs.
Bruce, Miss.
Cadell, Mrs. Elinor.
Cathcart, Miss.
Drynan, Miss Grace E.
Durham, Miss Mary P.
Graham, Miss.
Imlach, Miss Agnes C.
Mackay, Mrs. G. D.
Sutherland, Mrs. E. H.

Abernethy, J. Washington.
Aitken, Harry.
Allardyce, Colonel Jas.
Anderson, W. D.
Anderson, Captain P. W.
Berry, C. W.
Brodie, J. W.
Brown, Rev. John, B.D.
Brown, J. Paterson.
Bruce, D. Livingstone.

Cameron, J. Wilson, M.B., C.M.
Campbell, Ewen.
Campbell, P. W.
Dall, David M.
Davidson, Alastair.
Donald, C. W., M.B.
Duncan, Ebenezer, M.D., C.M.
Gavin, C. F.
Graham, Alex.
Graham, William.
Hill, Major Howard.
Johnston, Major J.
Johnstone, W. J.
Kermack, John.
Kidston, J. Burns, M.A.
Leask, J. Bruce.
Leiper, W. G.
M'Hardy, Lt.-Colonel A. B., R.E.
Mackay, George, M.D.
Mackay, G. D.
Mackie, R.
Mathieson, W. L.
Miller, A. Lawrance, M.A.
Pursell, Jas.
Reid, Sir J. Watt, K.C.B.
Robertson, E. H.
Ross, J. A.
Shepherd, Walter.
Simpson, G. A., M.A.
Skirving, Adam.
Smith, G. Kidd.
Smith, Malcolm.
Somerville, T. S.
Steven, Peter.
Trotter, J. Stuart.
Uhrich, W.
Webster, H. C.
Zimmerman, R.
—In all fifty-eight.

Ordinary Diplomas of Fellowship were conferred on Mr. John Maclauchlan, Dundee, and Mr. T. Craig-Brown, Selkirk.

Lectures delivered in December.

On December 22nd Colonel Andrew Haggard, D.S.O., lectured on "Our Soudanese Wars" in the Society's Hall, Edinburgh. Colonel Cadell, V.C., presided.

Colonel Haggard also addressed the Glasgow Branch on December 21st, when Professor G. A. Smith took the Chair; and the Aberdeen Branch on December 16th, Professor Pirie presiding.

The Dundee Branch held a meeting on December 23rd, when Dr. Dods gave "Sketches on Tonga and Samoa." Mr. I. J. Weinberg was the Chairman.

Lectures in January.

During this month Commander Balfour, R.N., will lecture in Edinburgh, and probably in Glasgow, on the Solomon Islands. It is also hoped that Major-General Sir Charles Wilson, K.C.B., will deliver an address in Edinburgh on trade-routes in the Upper Nile region. Due notice will be given of these lectures, when the dates, etc., have been fixed.

Lectures on the Unity of the Empire.

The lectures announced in last month's *Magazine* will be delivered in January, February, and March. Three will be given by Professor Kirkpatrick in January in the Society's Hall, the subjects being "The Anglo-Saxon People," "The Development of the Nation," and "Modern Problems." In February and March Professor Prothero will lecture on "British Foreign Policy," "Colonial Expansion," and "The Principles of Federation." Further information may be obtained from the syllabuses that will be distributed shortly to Edinburgh members.

These lectures will be open to the public free of charge.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Tides on the Norwegian Coasts.—At a meeting of the International Geodetic Association, M. Geelmuyden, director of the Christiania observatory, made some curious remarks on the tides on the coast of Norway. As regards these, the littoral is divided into two distinct parts, separated by a short section a little to the west of the most southern point of Norway (Lindesnäs), where the tide is almost imperceptible, probably owing to the interference of two waves, one coming from the Atlantic and the other, possibly, from the English Channel. Eastward of this strip of coast, on the borders of the Skagerack, the greatest difference between high and low tide is less than one mètre ($3\frac{1}{4}$ feet), and at all the stations the peculiarity is observable that the greatest daily range occurs not just after the syzygies, but about ten days later. Beyond the neutral zone, near Lindesnäs, the interval is usually one or two days. On the west and north coasts the tides are much stronger; beyond Trondhjem the maximum daily range exceeds ten feet. At all the stations where observations have hitherto been taken the range shows a regular increase towards the north. Tide-gauges are to be placed at Bodö (Rödö?) just within the Arctic circle, and in the Saltenfjord, where the water on entering and retiring through a deep narrow channel sometimes produces a formidable current.—*Ciel et Terre*, Oct. 1st.

The Surface Temperature of the North Sea and the Weather.—Professor Otto Pettersson, in the *Meteorologische Zeitschrift*, shows that a comparatively small change of temperature in the surface waters of the sea implies a vast quantity of heat imparted to the atmosphere, partly because the specific heat of water is great, and partly because cooled particles of water sink and give place to lighter particles of warmer water. For these two reasons the surface of the sea should be maintained in winter at a higher temperature than the land, and should tend to form low pressure systems, independently of its action in giving off aqueous vapour. From a large number of data collected by international co-operation, and from long-period averages from Danish, Norwegian, Swedish, and British stations, it is established almost beyond dispute that when warm oceanic water has entered the North Sea or Baltic in unusual quantities in autumn, a large number of cyclones accompanied by mild weather have been formed in the following winter, while, when the land streams are stronger than usual, pouring large quantities of cold fresh water into the sea and spreading it over the surface, the cyclones are displaced farther to the west and cold anticyclonic conditions are the result. Thus, the warm winter of 1894 was preceded and accompanied by the influx of vast quantities of warm water into the North Sea, while in the intensely cold winter of 1895 the southern part of the sea was entirely filled with fresh cold water chiefly derived from the land.

In the *Geographical Journal* for December, Mr. H. N. Dickson remarks that while the facts as at present known will bear no other interpretation, it is not easy to distinguish between the cause and effect. To thoroughly understand the distribution of waters near home it is necessary to have a fairly complete knowledge of the surface currents in the Atlantic and Norwegian Sea. When the influences controlling these currents have been investigated, it will probably be possible to foretell with confidence whether the winter is to be mild or severe, and possibly also whether the summer is to be wet or warm. Arrangements have been made

for taking observations in different parts of the North Atlantic during the years 1896 and 1897, and sixteen hundred samples of water have been collected during the first ten months of the period by the captains and officers of a large number of vessels. If the work is continued during the next year with the same efficiency, the evidence required to complete Professor Pettersson's theory will, to a large extent, be obtained.

ASIA.

Russian Colonisation in Asia.—The first centre of colonisation founded by agriculturists from Europe was at Vernoie, the capital of the province of Semirechie (seven streams). The province, which includes the country of the eastern Kirghiz, was voluntarily placed, about forty years ago, under Russian dominion by its inhabitants, who enjoy nearly complete autonomy. Numerous Russian villages have been established on the streams which descend from the Ala-tagh, and are now in a prosperous state. Like the oases of Algeria, each colony has its own stream and network of irrigation channels. The cultivated lands of Semirechie proper are situated to the north of Lake Balkash, between the river Karatal and the town of Serghiopol, but the most important agglomeration extends from west to east along the foot of the northern slope of the Ala-tagh.

The type of settlement recently adopted by the Russians in this region is a town of 4000 inhabitants, a number which is capable of cultivating the lands beside the stream for a distance of three or three and a half miles below the point where it emerges on to the plain. Each family receives on its arrival 148 acres of land capable of irrigation, and is also privileged to occupy as much as it pleases of land beyond the reach of irrigation. The houses are roomy and well built of adobe, which, when covered with whitewash, looks as solid as stone. The large windows are filled with sashes brought from Europe, or made of the willow wood of the country. All the roofs are made of sheet-iron, imported from Europe on the backs of camels. The constructions have only one story, for earthquakes are of frequent occurrence.

In many localities schools of arboriculture and agriculture have been established, where young Kirghiz are received and instructed for several years. It is thus sought to give the native population, which at present is exclusively pastoral, a taste for agricultural life ; but hitherto the success has been small.

There are also, besides the settlements already mentioned, villages founded by Chinese refugees, natives of Little Russia (chiefly Jews) and German Mennonites. The Russian peasants, usually addicted to drink, lazy, and deficient in intelligence, are not the best of colonists ; of the rest, perhaps the Chinese take the lead.

Some old settlements still exist which were towns or camping-grounds of the ancient civilised races who formerly owned the country. Such are Pishpek, Merke, and Tokmak, the last said to have been the capital of Jaggatai, second son of Jengis Khan. It stands at the entrance of the valley of the large river Chu, which through a narrow gorge leads up to the enclosed basin of the Issyk-kul. By this route Russian civilisation has penetrated to this lake, now partly dried up, which is situated in a basin of great fertility, surrounded by lofty mountains, one of which, the Tengri-nor, attains the height of nearly 24,000 feet. In spite of the altitude of the valley, 5354 feet, the colonies established here are very prosperous. The chief of them, at the farthest extremity of the lake, was formerly called Karakul, but now Przhevalsk, after the explorer Przhevalski, who died there. The crops raised in Przhevalsk, especially the cereals, are phenomenal. Other lines of colonisation run from Vernoie eastwards in the direction of Mongolia, terminating at present at Korgoz, Kopal, and Lepsinsk, and marking out the great commercial

and strategic routes which at some future time will probably permit the Russian Empire to annex Jungaria and an additional strip of Chinese territory.

The Government of Turkestan has endeavoured to follow on its territories the same system that has given such good results in Semirechie. Villages have been built on the Tallas and the more eastern affluents of the Chu, and in 1890-91 sixteen thousand families, driven out of Russia by the famine, and containing sixty thousand individuals, arrived at the same time as a considerable contingent of other immigrants.

In Bokhara, European colonisation has not made much progress. Some colonists have been introduced, but neither they nor the Russian merchants have been able to hold their own against the native cultivators and traders, who form a dense, laborious, economic, and intelligent population attached to the soil, and for a long time devoted to agriculture. The Slav race has here to give place to the Sart, which is decidedly superior.

Many centres of population and cultivation established before the European occupation have been developed and improved by the Russian administration. The least important and the most northern of these surrounds Taskent, the present capital of Turkestan, which now contains more than 150,000 inhabitants. It has always been a great commercial emporium where caravans meet from Siberia, China, Persia, Bokhara, and Europe. The oasis is not rich but very large, and is watered by numerous arms of the Chirchik river. Of Fergana much has already been reported in the pages of the *Magazine*. Being inhabited by an active agricultural population, it has been only protected and directed by Russia, and no colonists have been introduced into it. Of Samarkand and Zerafshan and their irrigation works and products, a considerable amount of information has been given in these pages. These and smaller oases lie within the territory of the Emir of Bokhara, and are not administered directly by the Russians.—*Mouvement Géographique*, Sept. 20th.

Meteorology of British North Borneo.—Dr. J. H. Walker publishes in *The British North Borneo Official Gazette* the returns from a number of stations. The rainfall in 1895 was 142·25 inches, and ranged at other stations from 82·82, at Kudat, to 168·94, at Loon P'sow in Sandakan Bay. The year was a rainy one, the mean for the previous five years being 141·90 inches, and for thirteen years only 127·87. A fair amount of rain falls every month, November and December being the wettest, as much as forty per cent. of the total falling at many places in these months. The number of rainy days is at all stations more than 150, and attains a maximum of 216 at Sandakan.

The temperature records are complete only for five stations—Sandakan, Pitas, Kudat, Gaya, and Labuan. The climate is decidedly warm, the yearly mean ranging from 71·28° at Pitas, to 77·37° at Kudat. It is, however, equable, the mean monthly maxima and minima having only a small range at most of the stations. Nor is the absolute annual range great; at Sandakan it amounted in 1895 to 22°, and at Kudat to only 19°. For some reason or other, at Kaningow the thermometer falls lower than elsewhere and the range is greater, a minimum of 54° having been observed in December, while the absolute maximum, 97, is several degrees above that of Sandakan or Kudat.

Siam.—In the November number of the *Geographical Journal*, Mr. J. S. Black gives an account of his observations during a journey of over 2000 miles in Siam. Chantabun, fourteen miles from the mouth of the stream of the same name, and 188 miles from Bangkok, though called the second port of Siam, is visited only by a few miserable canoes, and once a week by a steamer from Siam. Its population

is about 4000, and its exports insignificant in value, except pepper, of which the annual value is about £60,000. The plant is cultivated at the base of the Sabap hills, exclusively by Chinamen. From Chantabun runs the route to the sapphire and ruby mines in the adjoining provinces of Battambong and Krat, and, were it not for the existence of these mines near the frontier, there would be hardly any communication with Chantabun, for a range of hills 2000 to 3000 feet high, culminating in the Sai Dao, 5000 feet high, separates Battambong from Chantabun.

Battambong and Siamrap have gained the reputation of being extremely rich, fertile, and populous. This did not seem to Mr. Black to be the case, neither from what he himself saw, nor from the statistics he obtained. The combined population of the two provinces he estimated at 80,000, and the export and import trade may be valued at about £80,000 a year. The town of Battambong is a scattered village of about four thousand inhabitants, built on both sides of the Songkai stream, which during the dry season does not contain enough water to float an ordinary boat. Three miles above the town the rice fields end, and are succeeded by a treeless, grassy plain stretching out to the jungle, which fringes the horizon. The imports are cotton cloth and small quantities of miscellaneous articles. The cloth trade is almost exclusively British, and it is singular that British goods are conveyed overland from Bangkok, a long journey of two days by steamer, and about twenty days by bullock-cart, and are sold at a lower price in Battambong than French goods, which can be brought up by steamer during the rainy season from Saigon in two days. The mining district at Pailin, covering an area of six miles long by one and a half broad, is worked by a British company, the Siam Exploring Company. Large quantities of cheap stones are found, but some of the sapphires are as good as any in the market. The rubies are inferior, having a dark "clarety" colour.

Descending the Songkai, Mr. Black crossed the Talesap lake in three and a half hours, and came to Siamrap, which lies about ten miles from the shore. The lake is about one hundred miles long, and twenty miles across at the broadest part. During the rainy season the water rises twenty-one feet, and inundates the adjoining country for miles, while in the dry season it is only four or five feet deep, and then the people flock to the shores to catch the fish which swarm in the lake. Siamrap is a stagnant little place of two thousand inhabitants, but the pretty little rivulet which flows through it, shaded by palms and coconuts, is a refreshing contrast to the low swampy country that surrounds the lake. About four miles off lie the celebrated ruins of Angkor Wat and Angkor Thom.

Mr. Black's route from Siamrap lay through the western part of the Mekong basin, through Korat to Nongkai. The character of the country is much alike throughout the region. The trail winds through open jungle, the trees being about thirty feet high—mostly resinous trees of the *Dipterocarpus* genus. The ground is flat, except at the rise up to the Korat plateau, 800 feet above sea-level. Up to the Dong Rek hills the population is Cambodian and, beyond, Lao. This extensive tract of country suffers from scarcity of inhabitants and isolation. Nongkai, the largest town in the Mekong valley from Pnompenh to Luang Prabang, contains at most five thousand people, and Ubon and Korat are still smaller; yet these are the great centres of population in this immense territory. Wild animals are, naturally therefore, numerous—including elephants, tigers, leopards, bears, pigs, and deer.

Korat has a certain importance as being the depôt for the whole of this part of the Mekong basin, and even of some of the country on the left bank of the river. But the trade is small, and owing to their isolation the people do not seem to possess the instinct for trade that renders a country valuable. As is well known, the Mekong is closed to navigation by rapids, and Mr. Black thinks that *La*

Grandière (see vol. xii. p. 424) will have to remain on the upper reaches of the river, as the descent is still more difficult than the ascent. Thirteen miles from Korat is the river Nam-Mun, which is obstructed by rapids below Ubon, near its mouth in the Mekong. *Globus*, Bd. lxx. No. 19, speaks of its forming a navigable highway for a distance of 250 miles, but Mr. Black states that near Korat it contained only a few inches of water in the dry season, though he believes that a couple of launches were run for a short time during high-water from Ta Chang, near Korat, to Ubon. As to the route to Bangkok, it passes through dense dark forest, where malaria is prevalent, and pack-bullocks take ten days to reach Sariburi, which is within three days of Bangkok by boat. If the railway from Bangkok up the Menam were continued to Korat it would do much to improve the country. *Globus* states that it was to be completed last month, but Mr. Black, speaking in April last, could only say that it was constructed for a distance of seventy-five miles, leaving eighty to eighty-five miles as yet uncompleted.

The journey from Siamrap to Korat occupied eighteen days, and that from Korat to Nongkai fifteen, during which Mr. Black and his men suffered greatly from heat and want of water. At Korat, in a substantially built house, the thermometer rose to 100°, and remained above 90° till some time after sunset. The nights were comparatively cool, the temperature just before daybreak being 76°. From Paklai Mr. Black marched across country to Nan and Chiengmai. After the watershed between the Mekong and Menam was passed, the country and people changed for the better. Instead of flat, jungly plains, a country of sparkling streams, fertile valleys, and beautiful blue hills was traversed. The people looked more active, and their houses were large and solidly built. The chief wealth of the country is its forests of teak, which are worked by Burmese British subjects, and by means of British capital. It is curious that teak is not found of any size or quantity on the Mekong slope of the watershed, except on the Me Ing, and has never been heard of on the left bank of the Mekong. Chiengmai is a busy and cheerful town of, perhaps, twelve thousand inhabitants, situated on the Meping, at an elevation of 1000 feet, with the lofty forest-clad Doi Suthep towering up behind it to a height of 5500 feet. The journey of 537 miles from Chiengmai to Bangkok was accomplished by boat in eighteen days. The trade of the Menam valley Mr. Black estimates at four and a half millions sterling, as against a quarter of a million for that of the Mekong; and when the country is properly developed, and brought within easy reach of British markets, its produce will be much greater in quantity.

AFRICA.

Ascent of Mount Kenia.—In 1894-96 a Bavarian, Herr G. Kolb, made two journeys in the country between Kilimanjaro and Kenia, marching northwards through Ikutha. The Ukambani territory is a mountain chain running on the whole from south-south-east to north-north-west. It has no general name, the Wakamba giving names only to the individual peaks, and therefore Herr Kolb proposes to call it the Prinz Regent Luitpold range. It has a general elevation of 2000 to 5000 feet, with summits reaching from 5000 to 7500 feet; around it flow the Tana and its tributary the Tika-Tika on the north, and the Athi in the south. The basalt wall of the Yatha skirts the eastern bank of the Athi for three-fourths of its length. It is two to five miles broad, and rises 300 to 650 feet above the surrounding country, increasing in elevation from north to south; its top is as flat as a table. The Ukambani highlands are drained by numerous affluents of the Tana. The Wakamba probably number 400,000 to 500,000; they

cultivate the ground and graze cattle, turning their attention, since the cattle plague, to sheep and goats and the tending of bees.

Crossing the Kiloluma, as the upper course of the Tana is called, Herr Kolb marched to the Guasso Nyiro plain, where he shot a quantity of rhinoceros to barter for beans. He then made for Kenia, from the north-east side, passing the Gunga lake on the way. This crater lake, discovered by Mr. Neumann in 1894, is barely a mile in diameter, is surrounded by steep walls, and is drained by subterranean streams. Hippopotami live in the lake, though it lies 6500 feet above sea-level, and elephants and rhinoceroses come here to drink. After three days' march through tall forest the party came unexpectedly to another, larger lake, which the Ntorobbo call Sai. It is perhaps two miles long by one and a quarter broad. At night the temperature here sank to freezing-point. Three days later Herr Kolb reached the summit of Kenia, which he found to be a huge oval plain, with the pinnacle of Kisiruni rising from its southern edge, and that of Kilimara from its western. The plateau is thinly covered with grass, and a kind of rhododendron also grows on it. Kisiruni, which looks from the east like a typical volcanic cone, proved to be only a *coulisse*. The party marched all day long across the plateau, and at 4 P.M. came to a glacier brook, rather more than a mile from the Kilimara ice-capped peak. The men were then too exhausted to proceed farther, and had to pass the night there. The cold was intense, the thermometer falling by twelve o'clock to 9·5°. The height of the pyramid of Kilimara Herr Kolb estimates at 400 feet. If this be so, the height of the camp must have been over 18,000 feet. He proposes, without adequate reason, to change its name to Victoria Peak. Herr Holb has drawn a map of Ukambani and the neighbourhood.—*Petermanns Mitt.*, Bd. xlii. No. 10.

AMERICA.

British Columbia.—*The Annual Report of the British Columbia Board of Trade*, a copy of which has reached us through the courtesy of Mr. Troup, H.B.M. Consul at Yokohama, gives a favourable account of the mining and other industries in the colony. The output has continued to increase in Kootenay, especially in the Trail District, where the average value of the ore, consisting principally of gold, with a percentage of copper and silver, is $40 per ton. The Red Mountain railway, lately opened, connects Trail with two United States trans-continental lines, and another section will shortly be constructed from the same town to Robson, on the Columbia river, whence the Canadian Pacific main line can be reached by rail and steamer. Many of the most experienced miners believe that mineral wealth equal to that in any other part of the province lies in Cariboo. At present, the country is closed to any other than placer mining, owing to the expense of transporting machinery and supplies, and therefore the construction of the proposed British Pacific railway to Hudson Bay would have an incalculable effect on the development of this region. In the Omenica subdivision of Cassiar also, to the north of Cariboo, are creeks yielding gold, which may be reached by trail from the Skeena river. Oil has been found in East Kootenay, according to the *Canadian Gazette*, and promises to be very profitable.

The coasts of the mainland and the islands contain excellent building stone and marble, soft black slate, graphite, lime, liquid asphalt, and the best coal on the Pacific sea-board. The output of coal from the Vancouver mines in 1895 was 939,654 tons, a slight falling off compared to the previous year, owing to a reduction of the price of English and Australian coal by low freights. Both hematite and magnetic iron are extensively distributed in Vancouver island and

in Texada island, where gold, silver, and copper are also found. Of the Alberni district an account was given by Mr. Begg in vol. xi. p. 625.

The fisheries of British Columbia are probably the richest in the world. Though only two million dollars are invested in them, the exports of fish for the year ending June 1895 amounted to $3,264,500. The Fraser river is the chief source of supply, and in consequence of the favourable natural conditions, the success of the hatcheries, and the fishing regulations, there is no decrease in the quantity of fish. Hatcheries are to be established on other rivers. The catch of seals on the British Columbia and Japan coasts was less in 1895, owing to rough weather. The growth of the industry has been very rapid, and now the keen competition leaves only a small margin of profit to the owners of schooners.

At present there are 800 miles of railway in British Columbia, or about one mile to every 478 square miles of territory. One of the most important projects, already referred to, is for the making of a line from the northern terminus of the Esquimalt and Nanaimo railway to Seymour narrows, where a connection would be made with the mainland. Thence the proposed line would proceed eastwards to the Yellowhead Pass and be connected with a new railway in Canadian territory (see vol. xii. p. 204). The construction of the Crow's Nest branch of the Canadian Pacific would have a favourable effect on the mining industry of Kootenay.

The Climate of Alberta.—There is, we believe, great ignorance in this country as to the climate of this remote territory of Canada, and it appears from Mr. R. F. Stupart's remarks, who read a paper on the subject before the Canadian Institute (*Trans.*, October 1896), that almost as much uncertainty on the subject prevails in the Dominion. Mr. Stupart has studied and analysed nine years' observations at Calgary and eleven at Edmonton. The difference between the means for the winter months in different years is very striking ; for example, in 1891 the January mean was 20·9° at Edmonton and 27° at Calgary, the former being about that of Toronto, while in 1890 the Edmonton monthly mean was 6·8° below zero and the Calgary 3·5° below, or somewhere about the mean at Moose Factory, St. James Bay. The normal deduced from the eleven years' observations at Edmonton is 2·7°, and from the nine years' records at Calgary 9·4°. In February the means show the same tendency to great variations. The normal is 5·4° at Edmonton and 12° at Calgary.

At both stations the winter months are in some years excessively cold, but scarcely a month goes by without one or more intervals when the temperature rises to 40° or sometimes 50°. On seventeen out of the fifty-nine days in January and February the thermometer rises above freezing-point at Edmonton, and on twenty-three days in Calgary. On the other hand, at neither station has there ever been a January in which the temperature did not fall 20° below zero, and 57° below have been recorded at Edmonton and 48° at Calgary. With March a marked improvement sets in, and the normal is 26·8° for Calgary and 23·7° for Edmonton, while in April it rises at both stations to 39·3°. Scarcely a year passes without temperatures of 70° being recorded in this month. On comparing the records with those of other parts of the Dominion, it is seen that nowhere does spring begin so early as in Alberta. From May to November the temperature is lower than in the more settled parts of Ontario. The warmest month is July, with means of 60·5° and 58·8° at Calgary and Edmonton respectively, and maxima of 74° and 72·9°. The thermometer does not fall to zero till between the 15th and 20th of November.

The annual precipitation is 14·16 inches at Edmonton and 12·85° at Calgary, the greater portion falling in the form of rain between April and September.

There is a great deal of sunshine, the cloudiness being only about seventy per cent. of that of Toronto. The amount is about the same in summer and winter, and gives a yearly average of forty-three per cent. of the possible.

When a cyclone from the low pressure area of the North Pacific forces its way inland over British Columbia, the "Chinook" wind is felt in Alberta. These winds blowing off the sea are moist, and deposit their moisture in rain and snow on the mountain sides. The condensation sets free latent heat, and as the dry air descends the eastern slopes it is heated by compression and appears as a dry mild wind on the Alberta prairies. Accordingly the character of the seasnos depends on the track taken by storm centres. When a storm centre passes over Washington or Oregon, instead of a mild south-wester, bitter north and north-east winds, sometimes with snow, blow over Alberta.

Northern Bolivia.—Following on the heels of Dr. Roman Paz, an expedition started for the northern districts of Bolivia, part of which, under Don M. V. Ballivian, proceeded to Riberalta for the purpose of planning out a new town as the seat of the administration of the Amazon territory. Riberalta, standing sixty-five feet above the surface of the Beni, enjoys a healthy climate, and is admirably situated for a centre of government, since it commands the rivers Beni, Madidi, Madre de Dios, and Orton. The streets, roads, and squares of the new town will bear the names of the explorers who have traced out the geography of the country.

The northern limit of this territory is still a disputed question between Bolivia and Brazil. As explained by Dr. Cruls in the *Tour du Monde* (Nov. 7th), the difficulty is that, while the boundary is defined by the treaty of 1867 as running along the parallel from the confluence of the Beni and Madeira in lat. 10° 20′ S. to the principal source of the Yavari, the sources of this river certainly lie much farther north. In the demarcation of the frontier between Brazil and Peru, the sources of the Yavari were assumed to lie in 7° 1′ S. lat., but this is not yet an ascertained fact.

The chief natural wealth of this country is, of course, indiarubber. The exportation of this article is of comparatively recent origin in the Bolivian territory, and even twenty years ago hundreds of natives were carried off by force to work in the forests of Brazil, leaving their wives and children in the greatest misery. Since then, indiarubber has been collected by several firms in the Bolivian territory, and the natives are no longer kidnapped, though occasionally they seem to be treated cruelly, and some few cases Don Ballivian had to deal with on his way to Riberalta. The great obstacle to the development of the trade is the obstruction of the rivers by rapids. At present, about five per cent. of the goods carried along the rivers are lost by the foundering of the boats, and the loss of life is also considerable. This difficulty will soon be overcome, in part at any rate, by the construction of a road along the Madeira and Mamore, from San Antonio to the fall of Guajara-merim (see vol. xii. p. 480).

The indiarubber-tree of this country is called by the Portuguese *seringa*, because the juice is used by the Omaguas to make syringes—playthings much used in their festivals. Hence also its botanical name *Siphonia elastica*. It grows on an average to a height of sixty to seventy-five feet, and has a regularly cylindrical trunk, with a graceful spherical crown. The juice is extracted by making incisions in the bark, under which are placed tin cups. It is then dried in the smoke from a fire of the fruits of two kinds of palm, known as *cusi* and *motacu*. If allowed to coagulate of itself, the article is of inferior quality. Of late years, about 680 tons of indiarubber have been exported annually from the Bolivian territory alone.

AUSTRALASIA.

British New Guinea.—The following copy of a telegram from Sir William MacGregor has kindly been forwarded to us by Mr. J. P. Thomson, Corresponding Member :—

"Without loss of life or limb have crossed New Guinea from mouth of Mambare to mouth of Vanapa. Followed Mambare to foot of Mount Scratchley, where river divides to embrace the mountain. Ascended Mount Scratchley, on top of which observed with small theodolite. Found easy road west of Stanley range; without descending, reascended Mount Victoria to observe, but weather unfavourable. Descended Mount Knutsford, and found a not difficult road to coast. The miners have been at work at foot of Scratchley, the whole of which is probably auriferous. Wharton chain connects Mount Scratchley with the great Mount Albert Edward, which is also well inside British territory. All these great mountains seem composed of slate and quartz. No natives between Government station and Mount Scratchley. On the latter is a very friendly tribe. Excellent relations with natives from Mount Knutsford to the coast. Had scarcely a single completely dry day. I strongly dissuade any travelling towards the interior before April or May. Native carriers will not be permitted to proceed inland with Government sanction before then, when all possible facilities will be given to prospectors during the dry season."

The Mambare river flows into Traitor's Bay, on the north-east coast of New Guinea, about two miles within the German boundary. It is navigable by steamers for about forty miles, and on its banks are alluvial lands of considerable extent still unoccupied. On his first ascent of Mount Victoria, Sir William MacGregor noticed the connection of the Owen Stanley range with Mount Scratchley, and gave its name to Mount Albert Edward (see vol. vi. p. 252), which, it now appears, is connected with the former by a range to be called the "Wharton."

ARCTIC REGIONS.

Franz Josef Land.—The *Geographical Journal* for December contains Mr. Montefiore Brice's account of the work of the Jackson-Harmsworth expedition during the autumn of 1895, and the summer of 1896. In July of the former year, Mr. Jackson left his headquarters at Elmwood on Northbrook island in the whale-boat *Mary Harmsworth*, accompanied by Lieut. A. Armitage, Mr. H. Fisher, Mr. J. Child, and Mr. S. Burgess, whose place was taken a day or two later by Mr. Reginald Kettlitz. Having visited Cape Grant on Zichyland, and established a depôt there, they proceeded westwards to Cape Crowther and Cape Neale. From the summit of Cape Neale high land was visible to the westward, and on July 28th the party started again to obtain a nearer view of this land. Crossing Cambridge Bay, at the head of which appeared a bold and lofty headland, to which the name of Cape Fridtjof Nansen was given, Mr. Jackson passed in succession Cape Ludlow and Cape Lofley, and came to a majestic ice-capped promontory, rising two thousand feet above the sea, which he named Cape Mary Harmsworth. (Possibly this cape may prove to be the Cape Lofley of Leigh Smith.)

On this journey the capes and coast seen by Mr. Leigh Smith from the *Eira* in 1880 and 1881 were actually reached for the first time, and in extending the known coast of Franz Josef Land considerably to the westward, Mr. Jackson has, in Mr. Brice's opinion, rediscovered the mysterious Gilies Land. In 1707 Captain Cornelis Gilies, a Dutchman, sailed for some leagues east of the Seven Islands, and, having altered his course to south-east and south, sighted, when in lat. 80° N., high land about one hundred geographical miles east of North-east Land. This land

was also seen by Captain Carlsen of the brig *Jan Mayen* in 1863, and by Captain Tobiesen of the *Æolus* in 1864, but no navigator has hitherto succeeded in reaching it. Cape Mary Harmsworth, lying in 80° 30′ N. lat. and 42° 30′ E. long., is probably the southern point of this long-lost land.

Having passed the winter at Elmwood, Mr. Jackson started on another expedition on March 18th, and marched northwards through the archipelago to Cape Richthofen, near the 81st parallel. From this promontory, seven hundred feet high, open water was seen stretching northwards. On the west it washed against the glaciated land discovered on Mr. Jackson's former expedition, through the wide sound which he named the British Channel, and to the north-west two islands were descried. To the north lay an island which may prove to be the King Oscar Land of Payer. Between the north and north-east the distant view was hidden by the land by whose shores Mr. Jackson had travelled in 1895 about half a degree farther north, and where Nansen had spent the previous winter, but in that direction, towards the position of Petermann Land, was seen a dark water-sky, showing that the sea lay to the north of the chain of islands into which Zichyland has been resolved. This sea Mr. Jackson named Queen Victoria Sea. The *Fram* drifted in the pack round the northern part of it, and this confirms Mr. Jackson's opinion that he had reached the northern limit of the land masses.

Of glaciers there are very few of large extent, or of the common type. The ice-cap, which crowns nearly all the islands, seldom descends to the sea. Only on the south-east coast of Hooker island does a glacier send a broad tongue well out into the sea. The highest bergs seen are only seventy-five feet, and these are rare. The ice-cap and glaciers show little sign of movement, and when movement does occur, it is always slow, and crevasses are few. A slope of 15° is not rare, and, as a rule, crevasses are more frequent with a gentle slope. A map of Franz Josef Land accompanies Mr. Brice's article.

MISCELLANEOUS.

On October 16th traffic was commenced on the **West Siberian** railway, between Cheliabinsk and the Ob, a distance of 822 miles. The time occupied by this journey is fifty-one hours.—*Deutsche Rundschau*, Jahrg. xix. Heft 3.

A **biological station** is to be established at Honolulu, Mr. C. R. Bishop having given the sum of $750,000 for this purpose. Professors will be appointed, and students will be admitted to the institution just as at the station in Naples.—*Globus*, Bd. lxx. No. 22.

Mr. A. H. Neumann has reached **Lake Rudolf** from the south, and followed its eastern shore into the Randile country. Captain Bottego also is said to have reached the lake, and to be now on his way back to Mombasa. — *Petermanns Mitt.*, Bd. xlii. No. 11.

Ciel et Terre, October 1st, gives the following **heights of clouds**, obtained by Dr. E. Kayser from about 1500 measurements by the photogrammeter :—Stratus, 5590 feet ; Strato-cumulus, 7205 ; Cumulus, 9370 ; Alto-cumulus, 13,445 ; Cirro-cumulus, 21,437 ; Cirrus, 32,949.

The Chilian Navy is continuing the exploration of the myriads of islands lying off the west coast of **Patagonia**, and has again found that many that were supposed to be large islands are divided by fjord-like channels into archipelagoes. Chonos island, Wellington island, and now Queen Adelaide island, have turned out to be such conglomerations.—*Petermanns Mitt.*, Bd. xlii. No. 10.

The feat of exploring the **Niger** by navigating it down to the sea, planned a century ago by Mungo Park, has been accomplished by Captain Hourst. In January 1896 he arrived at Timbuktu from Bammako, and at the beginning of October reached Akassa. This journey has proved the navigability of the whole course of the stream, though at some points rapids encumber the bed.

One of the greatest natural curiosities of Java is the famous Gheko Kandka Gomba, or Home of the Hot Devil, known to Europeans as **Fire Island**. It is a lake of boiling mud, lying in the middle of the Grobogana plain, and is called an island because it looks like one in the midst of the luxuriant tropical vegetation around. It is two miles in circumference, and is fifty miles distant from Solo. Huge columns of soft hot mud rise in the centre and fall back to the surface, and large bubbles are also formed.—*Deutsche Rundschau*, Jahrg. xix. Heft 3.

The measurement of a great **base line** has been completed by the U.S. Coast and Geodetic Survey. It lies on the 39th parallel of north latitude, and extends across the continent, beginning on the Atlantic coast at a point ten miles south of the lighthouse of Little Egg Island, and reaching the Pacific six miles north of the Punta Arenas lighthouse, near San Francisco. This is the longest base line ever yet measured, and the work has cost the United States about a million dollars.—*Globus*, Bd. lxx. No. 22.

The twelfth **German Geographical Congress** will be held in Jena from April 21st to the 23rd. The chief subjects of discussion will be :—1. Report on Antarctic exploration of the committee appointed at the previous Congress. 2. Polar exploration (North and South Poles). 3. Geophysical questions (earthquakes, connections between gravity measurements, Earth magnetism, etc.). 4. Biological geography. 5. Home geography of Thuringia. 6. Questions relating to school geography. Visitors who wish to read papers on any of the above subjects should communicate with Dr. Kükenthal, Zoologisches Institut, Jena, before February 1st.

It has long been intended to found a new town on the **Murman coast**, near Yekaterinenport, and this year a Norwegian engineer, Blom Olsen, has been commissioned by the Russian authorities to lay out the town and erect the harbour dams. Fifty wooden houses have been constructed in Archangel, and will be transported to the site of the new town. The Government will urge the inhabitants of Kola to migrate to Yekaterinograd, as it is to be called. The lately discovered petroleum wells on the Pechora will be of great benefit to the town.—*Deutsche Rundschau*, Jahrg. xix. Heft 1.

A prize of £1000 will be given by King Leopold of Belgium for the best essay on the meteorological, hydrological, and geological conditions of **Equatorial Africa** considered from a sanitary point of view. The author should endeavour to deduce from the data, at present available, the mode of life, food, and method of working, and the kind of clothing and style of dwelling most favourable to health. The symptoms, etiology, and pathology of tropical diseases, and their treatment, should also be dealt with, and the conditions affecting the life of Europeans in various parts of the Congo basin should be discussed. The essays must be handed in before July 1st, 1897.

Mr. Bell Dawson, whose observations on tides in the St. Lawrence river have been noticed more than once, has contributed to the *Transactions* of the Royal Society of Canada a note on secondary undulations, and on exceptional **tides** in relation to wind and barometer. The secondary undulations are especially noticeable at St. John's, N.B., where their amplitude is large in proportion to that of

the tide. The tidal range is about twenty-eight feet, and the secondary undulations sometimes have an amplitude of over one foot, and a period of about twenty minutes, and sometimes continue for a week or longer. Such undulations were noticed at Halifax as long ago as 1863, and they have also been observed at Malta. No satisfactory explanation has as yet been given of them. High tides, six or seven feet above the normal, have been observed at Quebec following a drop in the barometer, but it is a question whether they are attributable to the effect of atmospheric pressure in the gulf, or at the mouth of the river, or are due to the effect of the wind in the St. Lawrence itself.

NEW BOOKS.

Fridtiof Nansen, 1861-1893. By W. C. Brögger and Nordahl Rolfsen. Translated by William Archer. London : Longmans, Green, and Co., 1896. Pp. 402. *Price* 12*s.* 6*d.*

Whilst Nansen's Arctic exploits have become household words in the geographical world, his ancestry, until revealed by this biography, was little known to the public. To those who believe in heredity it will be no surprise to learn that, both on his father's and mother's side, Nansen is descended from eminent explorers and soldier-adventurers of the seventeenth century. His ancestor, Hans Nansen, sailed, when a mere boy, from Flensborg to the White Sea in his uncle's ship. Afterwards, when barely twenty-one, he was placed at the head of an expedition sent by the King of Denmark to the rich fur regions about the Petschora. After that he held command for eighteen seasons in the service of the Iceland Company. In 1658 he was the leading burgomaster of Copenhagen, and defended it against the forces of the King of Sweden.

On his mother's side, Nansen is descended from the bold Barons of Jarlsberg, one of whom earned the name of "Dare the Devil" in the Thirty Years' War, whilst another went in quest of military adventure in Italy and Spain. Nansen's father was reporter to the Supreme Court of Norway, and was "a slightly built, little man." His mother was "a tall, stately lady," with a masculine will, devoted to the pastime of snow-shoeing, although it was thought unwomanly, and even improper, by her austere neighbours. Nansen was born near Christiania on 10th October 1861, and this work brings his life down to the year 1893, when the *Fram* sailed for the North.

After making a special study of zoology at Christiania University, Nansen went on an expedition to the Polar regions in 1882, and on his return was offered, and accepted, the position of curator of the Bergen Museum. He was then not yet twenty-one, thus rivalling his ancestor, Hans Nansen. In 1885 he contributed a folio of eighty pages on the anatomy of the *Myxostoma*. Three years later, he and a party of explorers left for Greenland, which they crossed, as detailed in his well-known work. Immediately after Nansen's return, he was appointed curator of the Zootomic Museum of Christiania University, and he married a lady who became noted as a public singer.

The book before us contains rather a rambling and unconnected account of Nansen's life, and is distended somewhat unnecessarily by the addition of chapters on Greenland, the Great Ice Age, and Arctic expeditions from the earliest times. The writers also occasionally descend to strange stories about trivial events, such as the tale of Nansen and the green egg (p. 29). On the whole, we look for a

better biography of Nansen than this one; although *faute de mieux* we gladly accept it, as giving the fullest account we yet possess of the geographical hero of the hour.

Rivers and Canals. The Flow, Control, and Improvement of Rivers, and the Design, Construction, and Development of Canals, both for Navigation and Irrigation. By Leveson Francis Vernon-Harcourt, M.A., Member of the Institute of Civil Engineers. Two vols. Oxford: The Clarendon Press, 1896. Pp. xviii + 392, and xii + 704. *Price* 31*s.* 6*d.*

Perhaps this is not quite the kind of book the reader would expect to see noticed in a geographical magazine; but it touches in so many points on matters geographical and commercial, that it should interest all travellers, particularly those in any way connected with the sea-borne trade of the world. The British Empire's share of that trade is represented by goods on the water, at any given time, to the value of at least £144,000,000 sterling.

The book has been admirably rearranged and almost rewritten. It contains an account of the great strides in this branch of engineering science since the first edition was published in 1882, and is so well illustrated by coloured plans and sections of the many engineering works of which it treats, that to the general reader the contents of these two volumes should be almost as acceptable as to the students of engineering. Explorers and geographers intending to give their views to the public may study this book with profit, for it will help them to form sounder ideas on the capacity of any new country for commercial development.

In reading the author's remarks about tideless and tidal rivers, one is struck by the fact that so few of the former, having sea outlets, are within the British Empire. The pioneers of trade appear to have been careful to select sites on tidal rivers for our early trading settlements. To meet the requirements of the present time, these sites need improving; and if more are to be occupied, they must be carefully considered from an engineering as well as a commercial point of view.

With the prospect of increased trade with China, the questions must arise, how far its great river and canal systems can be utilised for the heavier traffic; and to what extent railways will supersede them. Mr. Vernon-Harcourt shows how important and useful both old waterways and new railways have been in Western countries, and that experience it will be well to bear in mind, when railway schemes for China are placed in the Western markets. Eventually, there will be room for both railways and waterways; but, assuredly, the ultimate success of railways will depend on their judicious and gradual introduction. Millions of people, with their junks and small craft, are engaged in the internal trade; the vessels are not very valuable, wages are low, and merchandise can be conveyed cheaply by water from the sellers' to the exporters' doors. All these things are in favour of water-carriage; therefore, railways should at first be used for the passenger traffic, which is enormous, and afterwards gradually compete for the more profitable transport of merchandise.

Another question is sea-board harbour accommodation. In none of our Eastern ports of call and coaling stations are there sufficient facilities for our trade; nor are the ports adequately conserved. The local Chambers of Commerce have their harbour silting and shipping accommodation questions. Rival schemes are put forward, local governments are approached on the subject, and private companies may acquire rights which should never be granted by these governments if they are alive to the commercial interests of the ports, or of the future of the people. The experiments carried out by working models of some of the European harbours, as explained by Mr. Vernon-Harcourt, show that before important harbour or river

improvement work is sanctioned, it can be ascertained which of the alternative schemes proposed is most advantageous. Trade cannot afford to waste time and money on tentative measures as business is now conducted.

In America the silting up of some of the sea-ports is equally troublesome; but the State engineers are at work keeping those harbours as clear as it is possible to do with the funds and ingenious contrivances they have at their disposal.

Perhaps the chapters on interoceanic ship-canals will be the most appreciated by the general reader. The Panama Canal, as it is; the proposed Nicaragua Canal, "The Key of the Pacific," as it has been called, are worth attention; but still more instructive is the work of enlarging the Suez Canal, for when the sections and plans are compared with those of the original scheme and of older canals of smaller dimensions, it can be seen what enormous advances have been made in the construction of vessels for the sea-borne trade of the world, and how important are our country's interests in this great waterway to the East.

In Haunts of Wild Game. A Hunter-Naturalist's Wanderings from Kahlamba to Libombo. By Frederick Vaughan Kirby, F.Z.S. (Maqaqamba). With a Portrait of the Author, numerous Illustrations by C. Whymper, and a Map. Edinburgh and London: William Blackwood and Sons, 1896. Pp. xvi + 567. *Price* 25*s.*

This is a well-written, well-printed, and well-illustrated book of sport in that huge hunting veldt to the north of Swaziland, which may be described as bounded on the north by the Olifants River, on the south by the Crocodile River, on the west by the Kahlamba or Drakensberg Mountains (of which the Mauchberg reaches 8725 feet), and on the east by the Libombo Mountains. The first part deals with the game in the Krantz—*i.e.* the highest plateaus of the mountain ridge—and the kloofs, ravines, or hollows running through the foothills; the second part deals with the bush-veldt—the low country, or jachd-veldt, as the Boer hunters call it. In the higher regions Mr. Kirby's bag seems to have consisted chiefly of Reedbuck, Bush-pig, Bushbuck, Koodoo, Buffalo and Hill Leopard; in the lower, it included Blue Wildebeeste, Sable Antelope, Giraffe, Low Country Leopards, and many Lions. The book closes with an excellent fauna of the district, in which the names of the animals are given in the native forms as well as in English and Latin. Thus, the Ant-bear is Aard-vark with the Boers; the Bush-pig is Ingulubi with the Swazis; the Reedbuck is 'Mziki with the Zulus; the Sable Antelope is Zwaart-vit-pense, Black-white-belly, with the Boers; Buffalo is Inyati with the Zulus; Lion is Tau, and Leopard is Inkwi with the Basutos. In an interesting note Mr. Kirby shows how close are the resemblances of the Swazi and Zulu languages. It would be impossible to give any idea of the great variety of sporting adventure described in the book, or of the author's lively and picturesque style. He seems to have been well supported by his native beaters. The drawings of the head of the Koodoo (antelope) bull on pp. 136-7 are extremely pretty, and the likeness of the dog "Rover" gives one a great respect for that animal.

Moab, Ammon, and Gilead. By Algernon Heber-Percy, Author of *A Visit to Bashan and Argob*, etc. With Illustrations and a Map. Market Drayton: Bennion, Horne, Smallman, and Co., Ltd. London: Simpkin, Marshall, Hamilton, and Co., Ltd., 1896. Pp. vii + 101. *Price* 6*s.*

This is an agreeable and interesting narrative of a journey in the country east of the Jordan, which, owing to the insubordination of the Bedouin inhabitants, is more rarely visited by European travellers than the rest of Palestine. Crossing the

Jordan at Jericho, Mr. Heber-Percy went first southward by Nebo, Medeba, and Macherus to Dibon, whence he returned by another route to Medeba, and thence northward by Rabbath, Gerasa, etc., to Damascus. He made no discoveries of importance, nor can he be said to have added anything to what has been ascertained by previous travellers, but he has told what he did and saw simply and pleasantly, and he has brought back some excellent photographs of localities and persons, which enhance the value of his narrative. The story of his travels and these illustrations will be found specially interesting by any student of Book III. of Professor G. A. Smith's *Historical Geography of the Holy Land.*

Malay Sketches. By FRANK ATHELSTANE SWETTENHAM, Officier d'Académie. London: John Lane; New York: Macmillan and Co., 1895. Pp. xi+229. *Price* 5*s.*

Mr. Swettenham writes from the Residency at Perak, and his object is not to discuss political questions, or to give systematic geography, but only to awaken interest in the Malay people, among whom he has spent so many years. In this he has certainly succeeded, for his bright graphic sketches leave behind the picture of very real and living human beings. The Malays extract much innocent enjoyment from life, and nothing could be better than Mr. Swettenham's description of the fishing picnic, where dynamite cartridges are used to blow up the fish, and where, after lunch, the ladies and gentlemen pelt one another with unripe fruit. Another sport is the *meng-gelunchor*, or tobogganing down a waterfall, and the Sultan's annual expedition to the sand where the *tuntong* (river turtles) lay their eggs. Dancing goes on to the accompaniment of *chelempong* (harmonicon) and *gambang* (inverted bowls). There is among the Malays a singular hypnotic condition, called *lâtah*, of which the book gives some strange instances; and *ber hantu*, or raising the devil, a set exhibition of witchcraft, is also described. Mr. Swettenham shows much poetic feeling in what he says about river and jungle, and he evidently sympathises with the humanities as understood in Perak. A detailed account is given of the murder of the British resident, Mr. Birch, on 2nd November 1875.

Kaukasische Reisen und Studien. Neue Beiträge zur Kenntniss des kaukasischen Landes. Von C. HAHN. Leipzig: Duncker und Humblot, 1896. Pp. 299. *Price* 6 *M.*

The author of *Aus dem Kaukasus* has in this volume given us another interesting set of papers on the country and its inhabitants. He describes the scenery and his personal experiences on excursions to the Great Kabarda, the source-region of the Kuban, Northern Daghestan, and other parts, and has translated from the Russian some interesting information on tribal customs, the glaciers of the Caucasus, etc. The last chapter describes the Minor Caucasus, which, owing to the attractions of its mightier neighbour, has not received the attention its beauties deserve. Professor Hahn writes in a light and readable style, and his books should do much to make the general reader better acquainted with a part of the world remarkable for the grandeur of its scenery and the numerous remnants of ancient races that inhabit it.

Handbook of Arctic Discoveries. By A. W. GREELY. London: Sampson Low, Marston, and Co., 1896. 16mo. cloth. Pp. x+257. With Portrait and eleven Maps.

The present volume, by Brigadier-General Greely, is the third of the Columbian Knowledge Series, edited by Professor Todd. It is essentially a handbook, and

is not so much a collection of narratives as a summary of the results of various Arctic explorations, and a key to the vast literature dealing with the subject. Accordingly, the chapters are arranged in topographical order, each one dealing with some special area, and concluding with a concise bibliography, chronologically arranged, of the area under consideration.

Notwithstanding the great quantity of accurate statistics which General Greely has crowded into his all too short volume of two hundred and fifty pages, the book is one of great interest to the general reader, and is eminently attractive. It is a book from the perusal of which one rises with a renewed and augmented faith in the courage, self-reliance, and unselfishness of human nature.

Venice. By Daniel Pidgeon, F.G.S. London: Kegan Paul, Trench, Trübner and Co., Limited, 1895. Pp. vi+152. *Price 3s. 6d. net.*

This book consists of a series of very pleasing sketches of Venice and its architecture (with a special notice of the Ducal Palace), and of the lagoon and the exquisite views to be obtained therefrom. One chapter traces the rise of Venetian painting from Bellini through Titian to Tintoretto and Veronese; another treats of the Condottieri from the time of Werner, "the Enemy of God, of pity, and of mercy," as he called himself, to that of the friar Moriale and the German Count Lando; and a third puts together a few facts about the growth of Venetian commerce from the time of Orseolo II. (991-1009) (who first firmly secured the great trade with the East) down to the fall of Constantinople.

A History of Fife and Kinross. By Æ. J. G. Mackay, Sheriff of these Counties. Edinburgh and London: William Blackwood and Sons, 1896. Pp. xiv+404. *Price 7s. 6d. net.*

Although, as the author points out, this is not exactly a county history in the ponderous and extensive form to which we are accustomed, yet it is a perfectly adequate and deeply interesting description of Fife itself, of the Fife character and institutions, and of the prominent scenes and epochs in its history. Sheriff Mackay's great and varied learning has been utilised with a just sense of proportion, so that we see Fife in its natural place as part of the general growth of Scotland from the days of St. Serf to those of Bishop Low. The great events connected with Dunfermline and St. Andrews, the origin of the Scots navy under Wood, the origin of the movement for Reform at Cupar, the romance of Lochleven Castle, the murder of Lord Moray, the lives of Leslie and Henderson, the Secession movement—at what period does not the life of Fife connect itself with the general history of the country? Sheriff Mackay lays under contribution all the travellers who have left accounts of Fife; he sketches the development of its trade and agriculture; he discusses the peculiarities of Fife proverbs and Fife songs, and gives a long list of the distinguished soldiers, doctors, lawyers, and painters whom the county has produced. Certainly, if Fife had produced only Adam Smith, David Wilkie, and Thomas Chalmers, she might have been well content. The bibliography of the county alone occupies thirty pages of the work; while the printing in the same volume of Gordon's map, published in Blaeu's atlas, and of Bartholomew's modern edition of the Ordnance Survey shows the great development of the land during the last two centuries and a half. The book is extremely bright and pleasant reading. After all, why should a county history be dull? Blackwood is to be congratulated on the success of the first number of their County Histories of Scotland.

Hydrographic-Biological Studies of the Norwegian Fisheries. By Dr. Johan Hjort. Christiania: on Commission by Jacob Dybwad, 1896. Pp. 76 + 75.

The author's investigations on the Norwegian coasts, chiefly in the spring herring-fishery district in the neighbourhood of Haugesund, though also extended to the Lofoten Islands and other parts, have added another contribution to the hydrography of the North Sea. The movements of the cold Baltic stream, with its low salinity on the one hand, and of the warmer, salter Atlantic water on the other, are here exhibited, and their effects on the fisheries. Thus Dr. Hjort's work forms a connecting link between that of Dr. Pettersson in the south, and that of Mr. H. N. Dickson in the north. He, too, shows that both fish and plankton follow the bank water, or water of higher salinity and temperature. Many other details connected with fish life are contained in this volume, which is accompanied by tables of observations, and a good set of charts and diagrams. It should be found in the library of all students of hydrography and fishery.

Matthew Flinders; or, How we have Australia: being the True Story of Captain Flinders' Explorations and Adventures. By Robert Thynne. London: John Hogg, n.d. Pp. xii + 352. *Price* 3*s.* 6*d.*

Mr. Thynne is well known as a writer on the discovery and history of Australia, and is well qualified to describe the explorations of Captain Flinders. The volume before us seems to be intended chiefly for young people, and is supposed to be written by John Akin, who as a boy accompanied Flinders and Bass in the *Tom Thumb*. Much space is therefore devoted to incidents of an exciting character, such as the wreck of the *Porpoise*. Nevertheless, the particulars of the investigation of the Australian coasts, especially of the south coasts, might have been entered into more fully, and would probably have interested boys as much as the rather prolonged narrative of Flinders' unwarrantable detention at Mauritius. We have here, however, the chief events of Flinders' life accurately narrated in a condensed form. A good chart of the Australian coasts would have been much more useful than the very poor "Chart showing the Course of the Expedition," on which the course is not marked.

Archæological Notes on Early Scotland, relating more particularly to the Stracathro district of Strathmore in Angus, also some Account of Local Antiquities and Place Names, with Map, Plan, and Appendix. By William Gerard Don, M.D. Brechin: D. H. Edwards, 1896.

The title of this little brochure (98 + ix. pages) sufficiently details its contents. The map is a sketch one of the district in A.D. 1130, and if we could be sure that there is satisfactory authority for a majority of the entries belonging to the twelfth century, it would be of great interest. Even without this, it is of considerable value.

The author very justly protests against some of the archæological information of the Ordnance Maps; for, as he remarks, "the surveyors usually worked in districts to which they were strangers personally—Englishmen mostly in Scotland; and if, as understood, they were in the habit of referring archæological problems to local proprietors, how many, or rather how few, of the latter had any special competency to solve doubtful points!" The "exasperating ingenuity of English surveyors" requires everywhere to be guarded against, and, apparently, quite as much in Strathmore as elsewhere. The book is locally interesting, and supplies a

fair quota of information that is of value to the general student of ancient topography.

Leçons de Géographie Physique. Par ALBERT DE LAPPARENT. Paris: Masson et Cie, 1896. Pp. xvi + 590.

Professor de Lapparent has done a great service to geographers by publishing the courses of lectures on physical geography which he has delivered in recent years at the École Libre de Hautes Études. Lessons in Physical Geography is not altogether the proper title for the book, and the professor confesses in his preface that he would have called it "Lessons on the Genesis of Geographical Forms," or "Geomorphogeny," had he lived across the Atlantic. But in this country, as well as in France, there is an advantage in the more general title, for the book will probably receive attention from many of our teachers of physical geography who would have passed it over had it borne the more exact appellation.

There is great need for our teachers of geography to possess such a book as this. It is an attempt "to show the fruitfulness of a union of geography and geology, by a book forming a sort of bridge between the two sciences, where the second is discreetly employed no more than is strictly necessary, with the proviso, however, that the study of the existing forms must never be separated from the consideration of the past that has shaped them." It summarises in a most lucid and masterly way the work of many recent writers in Europe and America, who are trying to explain the various earth forms, not as static masses, but, one might almost say, as organisms with definite cycles of development. Much of such work is scattered in separate pamphlets, like the "Physiographic Memoirs" of the National Geographic Society, while some is to be found in Suess' wonderful classic, "Das Antlitz der Erde," and in Penck's more recent masterpiece on "Geomorphologie," none of which are very accessible to the ordinary teacher, who wants a concise and graphic description of the activities shaping the various forms of the earth's surface. Some chapters of Tarr's "Elementary Physiography" have supplied a simple introduction to this study of the evolution of earth forms for English readers, and those who have read them will turn to Professor de Lapparent's work with enthusiasm and profit.

The book of the French professor has an advantage over most works on physiography, which justifies in a way the title of "Lessons in Physical Geography," for the second half is an application to various regions of the principles discussed in the first half.

The writer treats in a broad but skilful style the geomorphogeny of different countries, bringing out the essentials very clearly in most cases. As far as we know, there exists no work in English which does this for the whole world; and, until there is, teachers will find de Lapparent's work most useful to consult, although they will often wish that this part of his book had been expanded into the treatise he warns the reader not to expect.

Professor de Lapparent belongs to the school of those who would allow earth movements a very important *rôle* in the evolution of earth forms. But if he sometimes seems to exaggerate their influence, he is none the less a most effective exponent of the effects of erosion, and the cycle of changes that occurs when the surface of the earth is exposed to it during periods of elevation.

A full account of the contents of the work will be found in the *Geographical Journal* for July 1896.

On page 332, Dunscamby is printed for Duncansby; and the distribution of Old Red Sandstone in the Shetlands is not quite accurately stated on page 334.

Stanford's Compendium of Geography and Travel (new issue). *Asia: Vol. II., Southern and Western Asia.* By A. H. KEANE, F.R.G.S. Maps and Illustrations. London: E. Stanford, 1896. Pp. xxiv + 526. *Price* 15*s.*

The volume before us completes this valuable work, which contains, perhaps, in point of matter, half as much again as the first edition. Statistics generally have been brought up to date, or nearly so; and as those given for 1881 in the earlier volume (though with some alterations) are repeated, the reader is enabled to trace the advance in various directions—population, trade, railways, canalisation in India, and so on. It seems a pity that the main canal arteries should not be represented on the map of India, which is not on a large scale—in fact, it is the map of the first edition, with some few changes on the northern frontier, due to the explorations of Sir M. Conway, Capt. Younghusband, etc., and recent Tibetan travellers, also referred to in the text. Recent territorial changes, owing to the French occupation of territory on the E. and N. borders of Siam, are also dealt with in text and map.

The plan the author has adopted is to retain the text of the first edition as far as possible, only making the necessary statistical changes. We venture to think there are some disadvantages attending this plan. Even when the needful changes of figures have been made in a passage some pages in length, some inconsistencies between the old and the new are apt to remain, or a necessary alteration may be overlooked; *e.g.* at p. 194 we read: "There are three armies belonging to the Presidencies of Bengal, Madras, and Bombay respectively, each army having a commander-in-chief." This was the case fifteen years ago. The abolition in 1893 of these commands, and the division of the forces into four local armies, each under a lieutenant-general, is noted on a subsequent page.

The Flora of the Alps. By A. W. BENNETT, M.A., B.Sc., Lecturer on Botany at St. Thomas's Hospital. London: J. C. Nimmo, 1896. Pp. xxii + 166 and 224. *Price* 30*s. net.*

In these two volumes the author has published a list of Alpine plants, with descriptions and illustrations, by means of which the tourist may identify the specimens he collects. A brief essay on the Swiss flora forms an introduction, and is a very attractive part of the book. Descriptions of the Classes and Orders are also given; these, to be of use to the non-botanical student, should, it seems to us, have been rather fuller.

The coloured plates, 120 in number, are, of course, of the highest importance in such a work. Many of them forcibly remind us of Lydon's (A.F.L.) illustrations in Wooster's *Alpine Plants*, which are strikingly artistic and graceful, and we regret that the dimensions of a small octavo page do not permit due justice to be done to the elegance of such plants as *Lychnis alpina*, *Dianthus carthusiorum*, etc. We also miss illustrations of *Trapa natans* and one or two other rare plants, to make room for which some of more familiar forms might have been omitted.

Notwithstanding these few defects, these volumes will be of great service to visitors to Switzerland, because they contain all the known Alpine plants, and the author deserves the hearty thanks of botanists for his painstaking and laborious work.

Mededeelingen uit de Journalen betreffende bijzondere Meteorologische Verschijnselen in sommige Gedeelten van den Oceaan. 2e geheel omgewerkte Druk. Uitgegeven door het Koninklijk Nederlandsch Meteorologisch Instituut. Utrecht: L. E. Bosch en Zoon, 1896. Pp. 117. *Price Fl.* 2.

The first edition of this work appeared in 1867, and in the intervening years

a large amount of new material has, of course, been received by the Instituut, and therefore a corrected and enlarged edition has become necessary. The present volume contains a multitude of observations from log-books on a variety of remarkable phenomena, such as fire-balls and meteors, the auroras of both hemispheres, the zodiacal light, submarine earthquakes, noteworthy storms, icebergs, mirages, etc. The chapters on disturbances of the compass at certain places, and observations on the Congo and the harbours of the adjoining Portuguese territory, are of great importance to navigation.

A Guide to Bombay: Historical, Statistical, and Descriptive. By James Mackenzie Maclean. Twenty-first Edition. London: Street and Co., 1896. Pp. xvi + 490 + cii + 223. *Rs.* 5.

The first edition of this handbook was issued just twenty-one years ago, when the compiler (now M.P. for Cardiff districts) was editor of the *Bombay Gazette* and Chairman of the Bombay Town Council, and has been revised and re-issued annually since. A book that has reached its twenty-first annual edition must be found useful by the public. It consists of two, or rather three, parts: (1) the Guide; (2) the Directory, containing a list of the principal European inhabitants of Bombay, extending to 102 pages; and the Official Directory, containing a mass of information respecting the different administrative, military, and other departments of Government; municipal, mercantile, and other information, occupying 223 pages. The first part, or Guide, extends to 290 pages, and contains a carefully compiled history of the city, with chapters on population, trade and industry, government and revenue, a systematic description of the city (125 pages), native festivals, etc., and a full table of through routes and fares to every place of note in India, with lists of ruling chiefs, etc., etc. The information seems most trustworthy, and to the tourist the volume will be indispensable.

An Almanack for the Year of our Lord 1897. By Joseph Whitaker, F.S.A. London: 12 Warwick Lane. Pp. 760.

In spite of several omissions, this new almanack is again slightly increased in size. This is an evil which the compilers of books of reference have always to contend with, and to avoid it in some measure the compiler has wisely adopted the plan of publishing an index to former volumes. The general plan of the present volume is the same as in former years, and the matter has been brought up to date with the usual care. Of the special articles, those on the "Geographical Progress," and "Boundary Treaties and Territorial Changes," by Mr. E. G. Ravenstein, are of most interest to geographers.

Hazell's Annual for 1897*: a Cyclopædic Record of Men and Topics of the Day.* Revised to November 21st, 1896. Edited by W. Palmer, B.A. (Lond.). London: Hazell, Watson, and Viney, 1897. Pp. 680.

As the New Year approaches, we always look forward to the issue of this valuable book of reference. The new articles are exactly those that will be most in demand. Thus, we find information on the present state of affairs in Armenia, Cuba, and Crete, a sketch of the late Arctic expeditions, and biographies of Nansen and the new Shah of Persia. The latest advances in chemistry, anthropology, and other sciences are also recorded.

NEW MAPS.

AMERICA.

NORDLICHES VENEZUELA. Verteilung der Vegetationsformation. Von Dr. W. Sievers. Massstab 1 : 3,000,000. Nebenkarte : Uebersicht der wissenschaftlichen Reisen in Nord-Venezuela. Massstab 1 : 10,000,000.
Petermanns Mitteilungen, Tafel 15, 1896.

CUBA, Karte von ——. Massstab 1 : 1,500,000.
Deutsche Rundschau für Geographie und Statistik, Jahrg. xix. Hefte 1 and 2.

ATLASES.

THE POCKET ATLAS OF THE WORLD. By J. G. Bartholomew, F.R.G.S., F.R.S.E., etc. Tenth Edition. *John Walker and Co., London.*

This is in much the same style as the *Handy Reference Atlas*, noticed in November, but on a much smaller scale. As in the case of that atlas, the present edition of the *Pocket Atlas* has been enlarged by the addition of local maps and plans on the back of the coloured sheets.

THE EXCELSIOR ATLAS OF AFRICA, containing twenty-four Maps, and Index to two thousand names. *Price* 1*s.* *G. W. Bacon and Co., London.*

A useful collection containing orographical, ethnographical, rainfall, and other maps, and a general map in numerous sections.

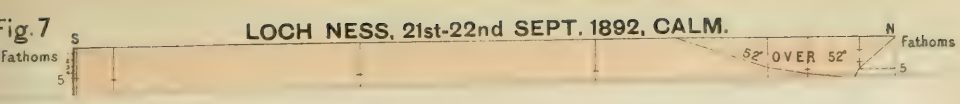
STILLER OZEAN. Ein Atlas von 31 Karten, die physikalischen Verhältnisse und die Verkehrsstrassen darstellend, mit einer erläuternden Einleitung, und als Beilage zum Segelhandbuch für den Stillen Ozean. Herausgegeben von der Direktion der deutschen Seewarte. *Hamburg: Friederichsen and Co.*, 1896.

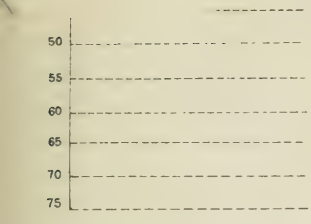
This valuable atlas is planned on the same lines as those for the Atlantic and Indian Oceans, which were published some years ago. The maps are full of information, not only of practical importance to the sailor, for whom they are prepared, but also to the geographer. Maps are given of the ocean depths, currents, specific gravity, temperature for different months (two or four) of both water and air, pressure, winds, a synopsis of the weather, rainy regions, magnetic elements for 1895, mean courses of ships, and the distribution of the principal species of whale.

It is difficult to compare the different interpretations of the still scanty soundings in the Pacific given by the German naval authorities with those of the *Challenger*. Not only are the contour lines drawn for mètres in the one case and fathoms in the other, but the German map shows ten gradations in place of seven on that of the *Challenger*. One marked difference between the two maps is that of nomenclature. Like the *Challenger* map, the German one introduces a new set of names, and unfortunately those of the latter are quite different from those of the former, and are based on the appellation of the adjoining land. Even the classic "Tuscarora Deep" has been sacrificed to the new system, and has been named "Nordwestpazifische Tiefe."

The chief change in the other maps from those we have in the *Challenger* report is in the trend of the air isotherm of 25° C., which is made to take an S-shaped bend south of the Equator in the east of the ocean in all the temperature maps.

Fig. 7





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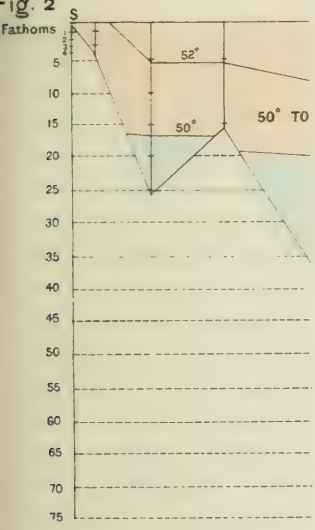

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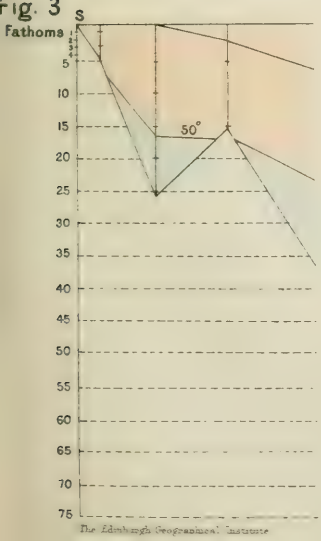
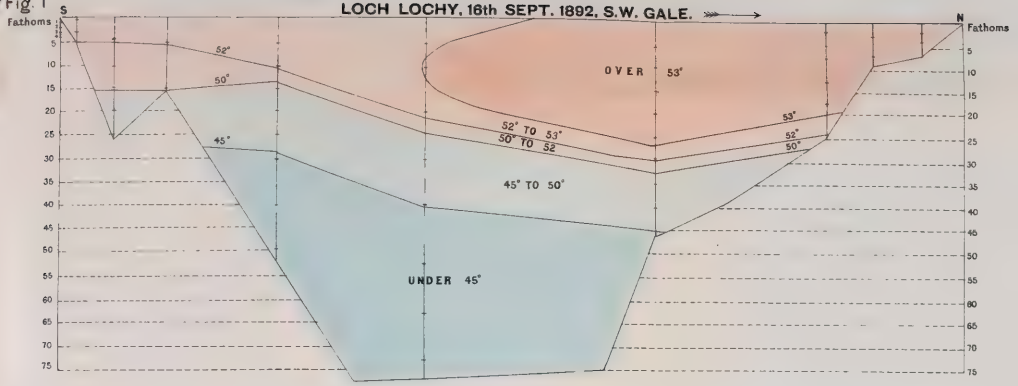
Fig. 3



The Edinburgh Geographical Institute

Fig. 1



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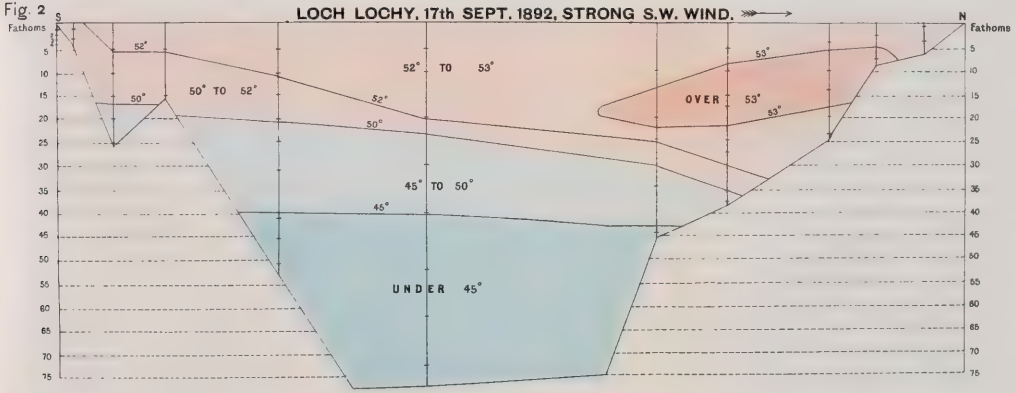

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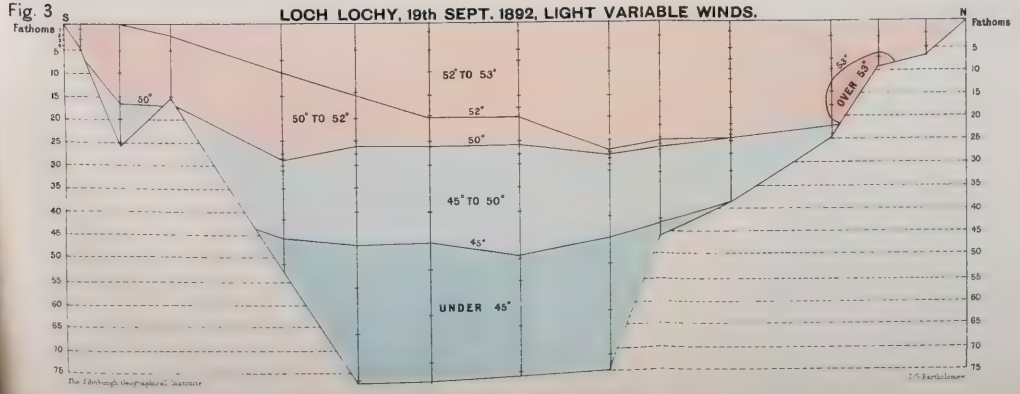

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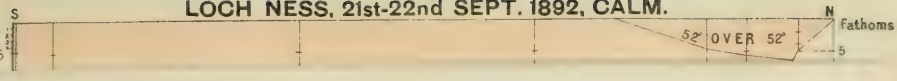


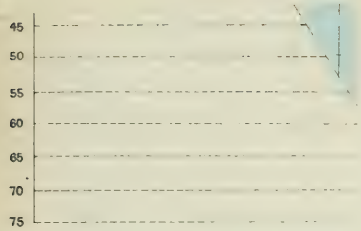
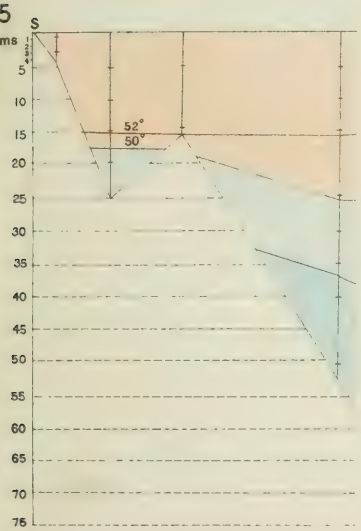


Fig. 5



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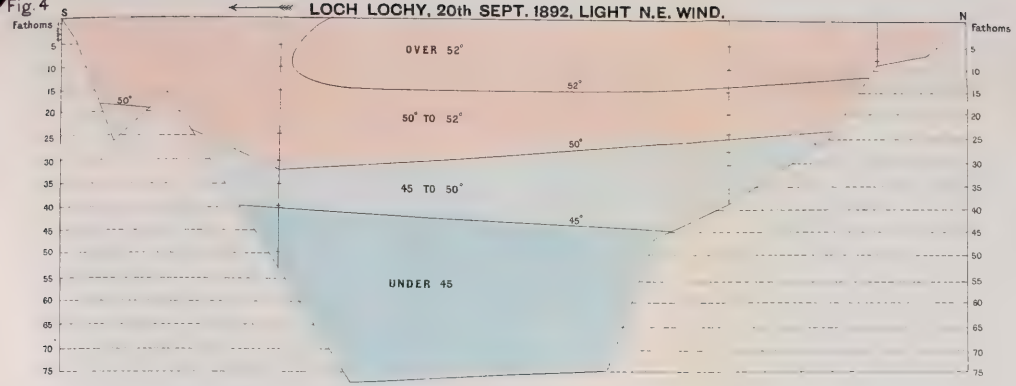

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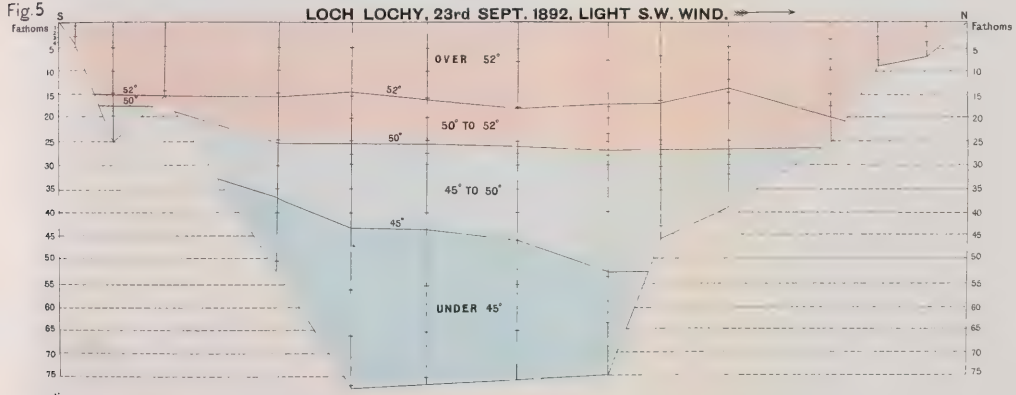

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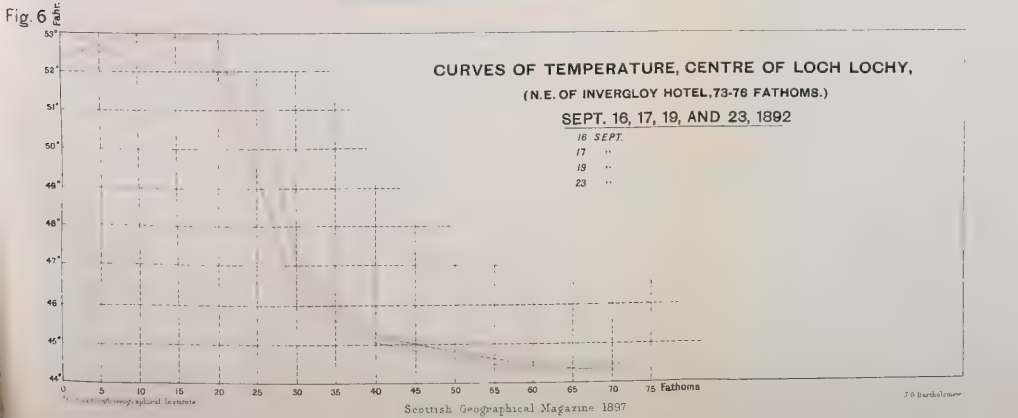


Fig. 7

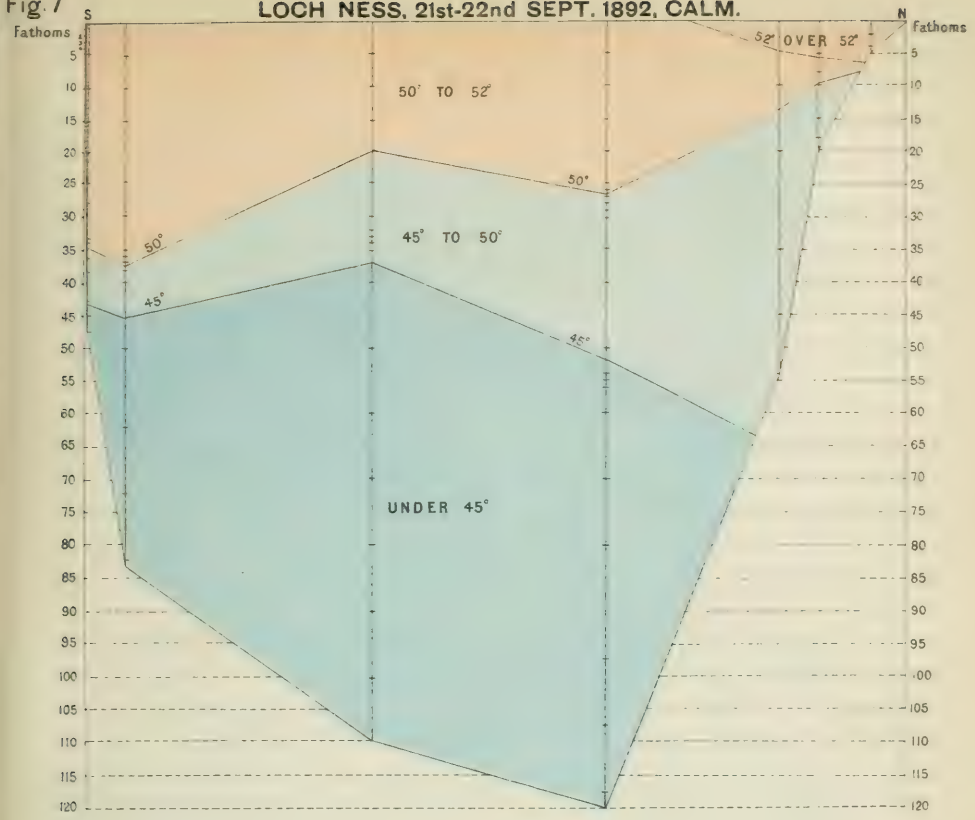
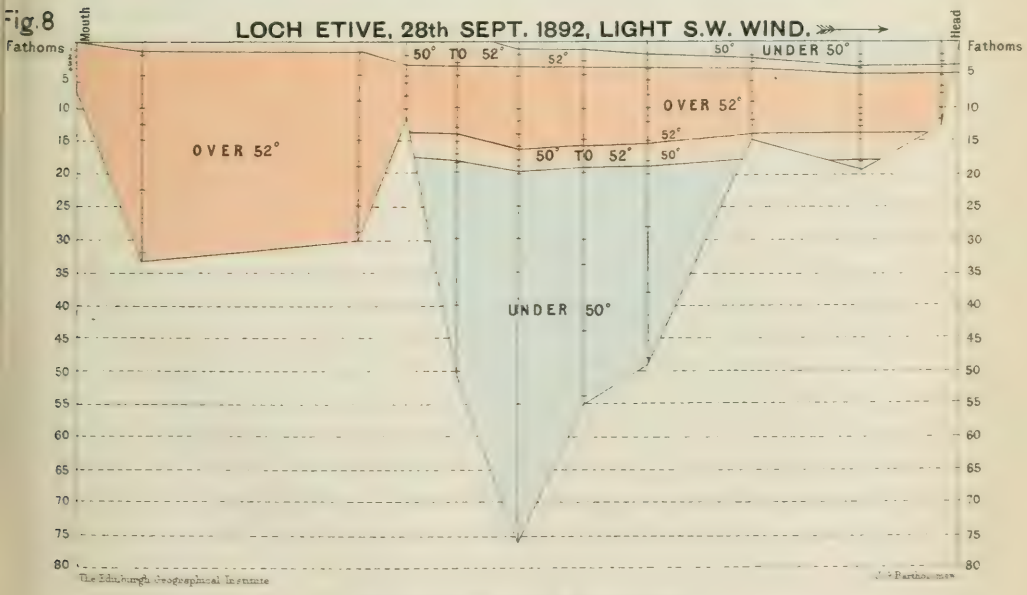


Fig. 8



The Edinburgh Geographical Institute

THE SCOTTISH
GEOGRAPHICAL
MAGAZINE.

ON RECENT EXPLORATIONS IN THE PATAGONIAN ANDES, SOUTH OF 41° S. LAT.

By Dr. Hans Steffen, of Santiago de Chile, Corr. Member.

The first attempts to penetrate into the wild mountain region of the Patagonian cordilleras, and to force a way from the coast of the Pacific up the course of the rushing torrents and through the dense primeval forest to the Patagonian plateau, were made by the zealous Jesuit fathers of Chiloë Island, and by some adventurous Spaniards who wished to open up communication with their vanished fellow-countrymen of the enchanted City of the Cæsars (*Ciudad encantada de los Césares*). In Peru, Chile, and Buenos Ayres, even in the ranks of Spanish colonial officials, this mythical city was for centuries a favourite subject of speculation. It was supposed to stand beside a large lake among the southern Andes, and was said to be inhabited sometimes by shipwrecked Spaniards, who had wandered thither from the Straits of Magellan, sometimes by colonists driven out of Southern Chile, and sometimes by Peruvian Indians, who had remained behind after the last Inca expedition to Chile.

The desire to discover the City of the Cæsars led to a long series of enterprises, of which the most important, to wit, the expeditions of the Jesuit missionaries of Chiloë, made their way through the Reloncaví fiord, past the Todos los Santos lake and the pass of Pérez Rosales, into the basin of the great Nahuelhuapi lake (in the second half of the seventeenth century and the beginning of the eighteenth). If the reports of Padre Olivares, the chronicler of the Society of Jesus in Chile, may be believed, the missionaries were also acquainted with another pass by which Nahuelhuapi might be reached with horses in three days from Ralun, the most northern extremity of the Reloncaví fiord. This noted Paso de Vuriloche (Bariloche is a corrupt form) must have run up

a valley skirting Monte Tronador on the southern side, the existence of which was proved by Herr O. de Fischer and myself during an expedition in January 1893.

After the demolition of the mission station on the Nahuelhuapi lake by the Puelche Indians in 1717, the Vuriloche route was forgotten, and it was not till near the end of last century that it was again sought for by the Franciscan father, Francisco Menendez. His efforts, however, as well as the more recent journeys of the Argentine captain, Rohde, in 1883, and of the Chilian naval captain, Valverde, in 1884 and 1885, which were undertaken with the same object, led to no results. But the advance of Herr de Fischer in November 1893 into the upper valley of the Rio Cochamó seems to show that with sufficient time and means it would be possible to travel from the shore of the Reloncaví fiord to the pampa at Nahuelhuapi through the valley of the above river and that of the Upper Rio Blanco, a feeder of the Todos los Santos lake, which rises in a glacier descending from the southern flank of Monte Tronador.

The other pass over the cordillera, already mentioned, which, starting from the Todos los Santos lake, ascends the valley of the torrential glacier-stream Peulla, towards the east, and, crossing the interoceanic watershed, reaches the great western arm of the Nahuelhuapi lake, was repeatedly traversed by P. Menendez, but was quite lost sight of during the first half of the present century until it was re-discovered in 1855 by an expedition despatched by Don Vicente Pérez Rosales, then Intendente of Llanquihue. But it was Dr. Franz Fonck during a journey in the following year, in which he explored part of the Nahuelhuapi lake, who first brought back really valuable scientific information, and first gave a reliable cartographic representation of the cross section of the cordillera in question. These results were afterwards extended and completed by the Chilian traveller, Guillerme E. Cox, who navigated the Nahuelhuapi lake and its feeder, the Rio Limay, where his canoe journey came to a sudden end among the rapids (1863).

In order to continue the geographical investigation of this mountainous portion of the Chilian province of Llanquihue, I made two small journeys in the summer holidays of 1892 and 1893, for the latter of which I received assistance from the Chilian Government. On this occasion I was accompanied by the draughtsman of the International Boundary Commission, Herr O. de Fischer. The chief scene of our labours was the region of the continental watershed, which, ascending the Peulla valley eastwards from the Todos los Santos lake, we crossed at several different points. It is by no means confined to the highest ridges of the mountain chains, but, at 41° S. lat., lies on a wide plateau with swampy meadows and small lakes, which is traversed by ridges of small relative height, is clothed with low bush (*Raulíes* or *Reulíes*), and contains extensive snowfields in its sheltered hollows. Its height above sea-level was found to be about 4300 feet. From the height of the watershed at this point are seen on all sides along the horizon lofty snowy peaks and groups of mountains, among which stands out conspicuously to the south the mighty mass of Monte Tronador with its

three pinnacles, of which two exceed 9800 feet in height. During the expedition, which was extended as far as a lofty chain to the east of Tronador, it was ascertained that the interoceanic watershed does not run, as was previously universally supposed, across the highest summits of Tronador, but over a lower ridge lying farther to the east, which, indeed, is connected with the main mass of the group, and crosses the snowfields whence the glaciers of the Rio Peulla descend to the Chilian side, and the great glacier of the Rio Frio, a feeder of the Nahuelhuapi lake, flows down through Argentine territory.

Between Tronador on the south and the plateau of the watershed, just mentioned, on the north, lies the broad depression of the pass (Boquete de Pérez Rosales) intersecting the water-parting mountain ramifications for a distance of nine miles. The altitude of this *boquete* is insignificant compared to that of the passes of the cordilleras in the more northern districts, for it attains only to 3323 feet, and therefore does not reach the limit of eternal snow. But the difficulties of traversing it, which was accomplished for the first time by our party on its return from the Argentine slope, were found to be very great, for we had to cut our way step by step through the thorny undergrowth of the primeval forest, and cross numerous deeply eroded gorges with rapid torrents. Recently some enterprising traders in Llanquihue, of German origin, have considerably facilitated the journey by establishing a regular boat service on the lakes of Todos los Santos and Nahuelhuapi, and by improving the paths in the cordillera; the Chilian Government also has granted money for the construction of a bridle-path.

It may, then, be expected that the Boquete de Pérez Rosales will soon acquire the importance in the trade between the two South American republics which its geographical position warrants. It is undoubtedly the shortest route between the colonisation territory on the Nahuelhuapi, with its rich pastures—to the owners of which the opening of an outlet to the Pacific coast has always been a vital question—and the flourishing agricultural colonies on the Llanquihue lake, which have a harbour, Puerto Montt, in regular communication by steamer with North Chile, and now even with Europe by the Hamburg Pacific line.[1]

The geographical exploration of the Patagonian Andes is closely connected with the solution of a series of hydrographical problems. There are many large rivers, of which the mouths and lower courses on the Pacific slope have been known for long, while the exploration of their middle and upper courses among the mountains has been almost impossible from the western side, owing to the forest and the difficulties of the ground. On the other hand, from the Patagonian plateau on the Argen-

[1] The most important observations on the surface features and geological formation of the country traversed in 1892 and 1893 were communicated by me to the *Richthofen Festschrift*, 1893, pp. 306-344, and to *Petermanns Mitteilungen*, 1894, pp. 145-154, with maps. The original report on the second journey, in Spanish, with an appendix giving an account of the cartographical work of the expedition, by O. de Fischer, and of the petrographical examination by R. Pöhlmann of the specimens collected, appeared in the *Anales de la Universidad*, Santiago de Chile, tom. lxxxiv. pp. 1167-1258.

tine side it is easy to follow on horseback the upper courses of the rivers until they enter the narrow gorges towards the west, where steep banks and rapids often present unsurmountable obstacles to the progress of the traveller. In consequence of the general eastward displacement of the continental watershed, the source-regions of most of the large rivers of the Patagonian cordillera flowing into the Pacific Ocean extend to the eastern offshoots of the mountains, and it is often very difficult, therefore, to lay down accurately a tract which is known only at its extremities, and to connect exactly the upper and lower courses of any particular stream.

Such a problem is presented by the Rio Palena, which enters the sea in about 43° 45′ S. lat. The Chilian Government sent out an expedition to explore it, which worked from December 1893 to March 1894 according to a plan of operations drawn up by myself.

The Chilian captain, Serrano, on a journey during the summer of 1886-87, established the important fact that, with suitable boats and an adequate body of porters, it was possible to advance by the Palena valley through the great bulwarks of the cordillera to a tract where the conditions of surface and vegetation were such as to offer no obstacle to free movement, especially on horseback. Here Serrano met a couple of mounted Indians, from whom he obtained some slight information about the source of the watercourse he was following. He then returned hurriedly westwards, partly because he was not prepared for a possibly hostile encounter with a larger troop of Indians, and partly because he feared that his retreat might be cut off by a forest fire which had broken out in the upper Palena valley. Could one, then, push on to Serrano's farthest point, and were one sufficiently equipped for the journey and provided with mules, it would be possible to reach some well-known point in the source-region of the Palena, and thus solve the problem of its origin.

Again, we had reports, though somewhat indefinite, of journeys from the Argentine side as far as a locality which could not be very far from Serrano's last camp. Of especial interest in this connection were the accounts of the expeditions of Colonel Luis Fontana (1885, '87, and '88), as well as his report of the foundation of a colony in 1886, at the instance of the Buenos Ayres Government, in the so-called Valle del Diez i seis de Octubre.[1] The colonists were Welshmen from Rawson at the mouth of the Chubut, who had taken part in the first journey of Fontana, and wished to establish a new home in that lonely corner of the cordillera, where they could retain their faithfully preserved Keltic manners and customs, far from the bustle of the outer world. From Fontana's narrative it appears that the waters of the 16th October valley converge into a great stream, which disappears to the south-west in the inner recesses of the cordillera, and is named by the Indians Staleufu. Somewhat farther south Fontana found another great river, which he called Carrenleufu; this, in the explorer's opinion, joins the Staleufu, forming the Chilian river Corcovado, which enters the sea under lat. 43° 15′. A

[1] In lat. about 43° 5′ S.; long. 71° 15′ W.

somewhat vague statement about a Chilian expedition, which appeared in the spring of 1887 on the Upper Carrenleufu, made by the Indians to Colonel Fontana, as well as the details we had collected on the hydrography of the Corcovado basin, rendered it probable that one, or perhaps both, of the rivers described by Fontana belonged to the system of the Palena superficially explored by Serrano. The positions determined by the two travellers cannot, however, be brought into agreement.

I drew up a plan, based on the foregoing reports and additional inquiries, for a Palena expedition, in which, besides myself, Herr O. de Fischer and the masters of the Chilian lyceums, Dr. P. Stange, P. Kramer, Dr. P. Krüger, and Dr. C. Reiche took part, the last as a naturalist. While Fischer, Dr. Reiche, and myself were to follow up the Palena from its mouth, the other members of the expedition were to start from Osorno and travel by known routes across the Puyehue pass and along the Nahuelhuapi lake to the colony of the 16th October, and then trace as far as possible one of the large rivers described by Fontana, in hopes of meeting the other section of the expedition. Did the meeting take place, the source-region of the Palena was to be explored by the united expedition, which would again divide on the return journey, one party descending the Palena, while the other would take a more northerly route through the Patagonian plateau.

In spite of serious misfortunes that befell both parties, the one in passing the numerous rapids of the Palena, the other owing to a storm on the Nahuelhuapi lake, a meeting was effected in the beginning of February 1894 in the upper valley of the river named by Fontana Carrenleufu, which, accordingly, was proved to be the main branch of the Chilian Rio Palena. Shortly after, however, a part of the expedition, with all the transport animals necessary for the continuation of the work, was captured by an Argentine frontier patrol, though provided with passports visaed by the Argentine Commissioner in the Valle 16 de Octubre, and carried off to Fort Junin de los Andes, 250 miles distant as the crow flies, so that the operations could not be completed according to the arranged plan. The reason for this absurd proceeding on the part of the Argentine frontier authorities was that they suspected the expedition of espionage; but its labours were carried on in a region which, though actually in the possession of Argentina, lies to the west of the ranges of the cordillera that form the watershed, and, consequently, according to the interpretation of the treaty of 1881 maintained by Chile, belongs to the latter republic. Fortunately all papers and drawings were secured, so that abundant material was obtained to work out.[1]

The scientific and practical results of the Palena expedition may be summed up under the following heads:—(1) The party that ascended the river surveyed with accuracy the Palena and its main branch, the Carrileufu of Serrano, the Carrenleufu of Fontana, and the Corcovado of the Welsh colonists, and ascertained the position of its source.

[1] My general report and the partial reports of the members of the expedition, accompanied by a special map of the Palena-Carrenleufu and a general map of the country traversed, are published in the *Anales de la Universidad*, tom. lxxxvii. and lxxxviii.

The Palena is formed, about sixty miles from its mouth, by the junction of the Carrileufu with a large stream flowing from the north, the Rio Frio. The icy water of the latter (40° F. with an air temperature of 50°) indicates that it is fed by the drainage of large glaciers; its lower valley is a longitudinal furrow, several miles broad, lying in the midst of the cordillera. Whether the Rio Frio is the Staleufu of Fontana, and, consequently, the drainage channel of the Valle 16 de Octubre, could not be determined owing to the interruption of the work of the expedition by the Argentine officials, and therefore the identification of the two rivers on Argentine maps [1] is a pure assumption; indeed there are weighty reasons for supposing that the Staleufu does not belong to the Palena system at all, but is a tributary of another, as yet little known, hydrographical basin of the Patagonian west coast, perhaps that of the Rio Corcovado, Chaiten or Canef.[2]

The Carrenleufu is a true woodland stream, in its lower course winding its way with long meanders through a beautiful alluvial plain covered with dense primeval forest, while farther up, confined in a narrow cañon, it presents insuperable difficulties to navigation. On the slopes of its valley are frequently seen clumps of the so-called *cedro* (*Libocedrus Chilensis*, Endl.), which, apparently absent from the Patagonian littoral, occurs in the high cordillera from about 34° S. lat. southward.[3]

Beyond, that is, to the east of the cañon-like contractions, expands the broad upper valley of the Carrileufu, clothed with tall meadow grass and brushwood, and extending to a breadth of about six miles. The forest proper has, for the most part, fallen a victim to destructive fires, and the country can be crossed in all directions on horseback; the river, too, branches off into numerous arms. On the east the valley is hemmed in by high ranges, which are connected with the snow-capped elevations of the central part of the cordillera on the south, that is, in the direction of the source of the Carrileufu, and along which passes the watershed between the Palena and the Rio Teca of the Chubut territory. According to Argentine maps the Carrileufu has its origin in a large lake (Lago General Paz) which Serrano heard of from the Indians.

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[1] Ezcurra, *Plano del Territorio del Chubut* (1 : 1,000,000) in the *Bol. del Instituto Geogr. Argentino*, xvi., cuad. 5-8, 1895.

[2] See the discussion of this question in Dr. F. Fonck's excellent commentary on the travels of P. Menendez (*Viajes de Fray Menendez a la Cordillera*, Valparaiso, 1896), pp. 73, 74.

[3] Just as in last century the legends of the enchanted City of the Cæsars gave rise to various expeditions up the Palena, which, indeed, all turned back at the first rapids and accomplished nothing, so in recent times an exaggerated belief in the existence of enormous natural wealth in the valleys of the interior has been the cause of some unfortunate enterprises. In particular, it was believed that extensive woods of *cedro*, the wood of which is well adapted for industrial purposes, were to be found at easily accessible spots. Now and then, too, scorched trunks of *cedros* were seen floating down the stream, and credulous Chilotes supposed that they came from inhabited country on the Upper Palena. On the contrary, it may be said that the *cedro* woods on the Palena are nowhere of considerable extent, that they are found only far in the interior and generally on inaccessible rocky slopes, and that the transport of the trees, even to the river bank, would involve immense labour and expense. The scorched trunks, which now and then may have come down almost to the mouth of the river, have been washed down by floods from the burned forests in the upper Carrileufu valley.

(2) The geology of the Palena valley could, of course, be studied only imperfectly, for forest-clad mountains and alluvial plains, where the traveller must laboriously win his way step by step, are very unpropitious ground for scientific observation, especially when an expedition is pressed for time. But one fact may be considered certain—that along the whole line of the Palena valley, from the coast to the watershed on the edge of the Patagonian plain, old Plutonic rocks predominate; granite and norite on the Palena fiord and on the valley slopes of the lower basin of the river; quartz-porphyry farther up as far as the confluence of the Carrileufu and Rio Frio; and granite with isolated norites and diabases where the river has cut a channel through the cañons. Specimens of mica-schist were found only in the gravel washed down by the torrents that leap down from the inaccessible central heights of the cordillera, whereas I found it *in situ* on former journeys in the Tronador group, and on the watershed between the Todos los Santos and Nahuelhuapi. The entire absence of recent eruptive rocks is singular, basalt and andesite occurring in the more northern parts of the cordilleras of Llanquihue (Rio Petrohue, the frontier land of the Boquete de Pérez Rosales, etc.). At one spot, close to where the Carrileufu enters the long cañons, are banks of hard limestone, shading from dark blue to smoke-grey, which run east-north-east with a dip of 20°; their age could not be determined, the fossils I collected being too fragmentary. The elevations which skirt the upper valley of the Carrileufu seem again to be composed of granites.

(3) At the present day there are no longer roving troops of Indians in the Palena district, such as Captain Serrano encountered. The names of the villages (*tolderias*), also, which are known to us from Captain Musters' *At Home with the Patagonians*, are almost forgotten. No doubt the valley visited by Musters in the company of Tehuelche Indians, with the object of hunting wild bulls, is that of the Upper Carrileufu, and therefore that daring traveller was probably the first white man to visit the source-region of the Palena river.

Attracted by the great agricultural value of the valleys enclosed between the heights of the watershed and the central snow-covered mass of the cordillera, Argentine colonists, or colonists under Argentine rule, have commenced to settle in them. The colony in the valley of the 16th October, easily reached from the open pampa by broad passes (2000 and 2400 feet above sea-level), abundantly watered and with a mild climate and splendid pasture lands, promises to become the centre of a prosperous district, peopled by agriculturists and cattle-grazers. These lands have, besides, acquired additional value through the discovery of auriferous deposits in the alluvium of the Rio Corintos and other rivers of the same valley that flow to the Staleufu river. It is not to be wondered at, therefore, that the Chilians uphold the claims given them by delimitation treaties to the possession of those valleys, which all lie to the west of the ranges constituting the watershed, and that they await with anxious interest the decision of the commission on this delicate point.

The Chilian Government, whose attention had been directed since the journeys of Captain Serrano to the value and importance of the

Palena valley, decreed on January 4th, 1889, the foundation of an agricultural colony at the mouth of the river on an island (Isla de los Leones) which lies between the far-penetrating arm of the sea, or Estero Pichi-Palena (that is, Little Palena), and the lower extremity of the river, Vuta (Great) Palena. No expense was spared to promote the steady progress of this newly formed station on the steep, uninhabited coast of Patagonia; but, in consequence of inefficient management, the great expectations which were cherished at the commencement were not fulfilled, and now only a couple of Chilote families live there, leading a miserable existence in isolation from the rest of the world. For all that, the place possesses exceptional advantages as the site of a colony and a naval station, and it is much to be wished that the Chilian Government would consider the suitability of this fine harbour at the mouth of the Palena as an intermediate station on the long, desolate coast between Reloncaví and the Straits of Magellan, and as a base for the colonisation of the inner valleys of the Palena cordilleras. The largest ocean steamers could enter freely into the fiord-like inlet of the Pichi-Palena, where they would find ample shelter against storms and the surf of the outer Corcovado gulf, and good anchorage off the east coast of the Isla de los Leones. This island is separated from the mainland on the east by two channels, which afford a waterway between the Palena river and the Estero Pichi-Palena, so that small vessels on their way to the river can make use of the entrance through the Estero, and thus avoid the great bar at the mouth of the Palena.

Although extensive alluvial flats skirt both banks of the Lower Palena, which seem suitable for grazing, it must, however, be observed that all these low-lying lands are constantly threatened with inundation when the river overflows its banks, in consequence of the very frequent and most exceptionally violent rains in the lower valley. We saw traces of such floods at a height of twenty to twenty-three feet above the ordinary level of the stream, and were occasionally disagreeably surprised by sudden flushes rising several yards, which were caused by great downpours of rain and the damming up of the current by squalls.

The most important task of the administration of Palena is certainly the opening of roads into the interior, in order to establish communication with the far more valuable valleys on the Upper Carrileufu and Staleufu. It would be easy, by blasting and dredging, to render the Palena navigable for small steamers as far as its first great affluent, the Rio Claro, a distance along the course of the river of about forty-six or forty-seven miles; and farther on roads might be cut without difficulty through the forest, detours over the elevations beside the banks being necessary only at a few places to avoid the cañons. In any case, the height to which a road running up the Palena valley must rise would be far below the snow limit. According to Dr. Krüger's hypsometrical calculations, the valley of the Upper Carrileufu lies at an altitude of 1400 feet, and the Valle 16 de Octubre at only 1300 feet.

(4) The most important result of the labours of the party which travelled from Osorno past the Nahuelhuapi lake, and over the Patagonian plain southwards, is the determination of the geographical

co-ordinates and altitudes of all the principal stations on the route. The observations and calculations are the work of Dr. P. Krüger, who has published his report in two memoirs contained in the *Anales de la Universidad*. By these observations, the positions of several points hitherto given very diversely on maps have been definitely settled, as for instance, the pass of Puyehue, the extremity of the Nahuelhuapi lake, the Valle 16 de Octubre, etc.

When in December 1894 I received the means of continuing my investigations in the Patagonian cordillera from the Ministry for Foreign Affairs and Colonisation, through the kind intervention of the Chilian expert on the Boundary Commission, D. Diego Barros Arana, who had always energetically promoted our former enterprises, I represented to the authorities that one of the tasks most pressingly demanding attention was the exploration of the large rivers that enter the sea immediately to the north and south of the 43rd parallel, especially the Rio Corcovado and its connection with the stream draining the Valle 16 de Octubre to the west. The expedition would also throw light on the question of a possible connection of the latter with the Rio Palena, or rather with its large northern tributary, the Rio Frio, and thus the northerly and north-easterly extension of the Palena system would be clearly defined.

Various causes combined to render the execution of this project impossible at that time; for one thing, there was no probability of procuring a large vessel to carry the expedition to the uninhabited coast of the Corcovado gulf. The season, too, was already so far advanced that it seemed impossible to carry out the whole plan during the summer vacation at our disposal, especially when the difficulties and loss of time were taken into account which would be incurred by a preliminary survey of the coast and the search for the right waterway, in case the Rio Corcovado proved to be useless as an entrance into the interior.

I therefore proposed to the Minister as a field for our activity a more northern river basin, the exploration of which would likewise add considerably to our knowledge of Western Patagonia, and which seemed likely to give a comparatively short line of penetration into the interior of the mountains and to the continental watershed beyond. This river was the Rio Puelo, the large eastern affluent of the Boca de Reloncaví, the source-region of which I proposed as the goal of an excursion which I hoped to accomplish successfully in the space of one and a half to two months. The provisional plan of operations, which I soon after handed in to the Minister, specified, as the chief task of the expedition, the tracing of the Puelo valley, if possible, to its head, and an inquiry into the existence of the large mountain lake figuring on maps as the Lago Puelo, which had never yet been seen, and had been given a place on Chilian and Argentine maps only on the ground of a theory of the Chilian captain, Vidal Gormaz. A secondary object of the journey was to reach the main watershed of the Andes, and possibly form a junction with the route of the Palena expedition at some known point on the Patagonian plateau at the eastern foot of the mountains.

Dr. Paul Krüger had already intimated his willingness to accompany the expedition, and to him was intrusted the work of determining positions astronomically, and the hypsometrical and meteorological observations. The control of the whole enterprise, and in particular the setting of the route, the sketching, photography, and geological collections were reserved for myself. The instruments we took with us were three chronometers, one alt-azimuth, one Fortin barometer, two aneroids, one boiling-point thermometer, wet- and dry-bulb thermometers, a sling thermometer, a prismatic compass, and a photographic camera with several dozen film plates.[1]

The portion of the Patagonian cordilleras drained by the Rio Puelo was practically unknown until the journey of the Chilian captain, Francisco Vidal Gormaz, in 1872, and all the representations of it on older maps, that of Pissis, for instance, are more or less imaginary. It is vain to search for the name Rio Puelo in the narratives of the Spanish naval officer, José de Moraleda y Montero, who in 1795 sailed along the whole length of the Boca de Reloncaví and surveyed it. Moreover, on his large map no important affluent of the Boca appears which might correspond to the Puelo. He mentions only the Yate plain (Llanos de Yate), which stretches from the foot of the mountain of the same name (Monte Yate) to the mouth of the Rio Puelo, and even then perhaps served as a rallying-point for lumberers of Chiloë on their return from their wanderings through the neighbouring forests of *Fitzroya Patagonica* in the cordilleras.

The journals of Padre Francisco Menendez, who shortly before Moraleda made several missionary journeys through the Boca de Reloncaví and across the cordillera into the basin of the Nahuelhuapi lake, contain hardly any details about the Puelo, though he must several times have passed close to its huge mouth, which makes its effect felt on the current far out into the Boca. The version of his report, published in the *Annuario Hidrográfico de la Marina de Chile*,[2] contains no mention of the Puelo at all; but in another manuscript, in the possession of Dr. F. Fonck (at Quilpué), a few details about the river are inserted.

My men often spoke to me of the journey of a certain Paulo Téllez, the founder of the family of that name now spread over Chiloë and Reloncaví, who is said to have come to Chile by the Puelo route as a refugee from the Argentine side (?). Generally all these reports prove to be unfounded gossip; in earlier times only the lowest part of the Puelo was really known to the Chilotes, perhaps as far up as the first great rapids. Here they sought for *Fitzroya*, cypress, and *cedro* timber, and cleared the level stretches beside the river to obtain grazing-ground for their cattle and room for small settlements (*chacras*). Now and then a herdsman on the track of strayed cattle, a prospector, or some

[1] The original reports of the expedition into the hydrographic region of the Rio Puelo were published at the time in the *Anales de la Universidad* (August, September *et seq.*, 1896). A general map, on the scale of 1 : 250,000, was appended. See also the preliminary accounts in the *Verhandl. der Gesell. für Erdkunde zu Berlin*, 1895, Nos. 4 and 5; *Petermanns Mitt.*, No. viii., 1895; and *Globus*, Bd. lxx. p. 18.

[2] Tom. xv. p. 3.

enthusiastic rover of the woods, may have reached the large lakes in the lower river-basin, but the impossibility of going round them, either by the shore or along the heights above, soon put a stop to their further progress. The inhabitants of the island Huar, lying in the Reloncaví gulf opposite the entrance of the Boca, formerly enjoyed the reputation of being best acquainted with the Puelo valley, and therefore Captain Vidal organised his Puelo expedition there. Now the journeys of Huar islanders have become less frequent, because the valuable timber within easy reach has been nearly exhausted in the lower valley.

When the Chilian traveller, Guillerme Cox, in 1859, undertook his voyage of exploration in the Boca de Reloncaví, he succeeded in collecting some reliable data respecting the direction of the course of the Puelo and its waterfalls, as well as some information regarding the general character of the valley, on the ground of which he expressed his opinion that the source of the river must be looked for in the Cerro Tronador. Afterwards Pissis adopted his theory, and entered in his map a "Rio Peula." flowing down from Tronador in a north-easterly direction.

Fuller and more correct information was obtained by Dr. Fonck a few years before (1856), on the occasion of his journey to the Nahuelhuapi lake, from his pilot, Pedro Maria Uribe. The most important point in this description is the suggestion that the origin of the Rio Puelo should be sought for in a lagoon. The same suggestion was afterwards made by the Chilian captain, Vidal Gormaz, who on January 15th, 1872, set out from Ralun to explore the Rio Puelo, accompanied by his subaltern Rogers and the guides Manuel Oyarzun and Manuel Téllez. The chief credit of the achievements of this expedition is due to Rogers, for on the second day of the journey, after passing the great rapids on the lower course of the river, Vidal fell ill, and had to abandon all thoughts of a further advance into the interior. His companions continued the journey in a small boat, overcame innumerable obstacles to navigation, and on the sixth day came to a halt at the foot of a mighty rapid that their boat was unable to face. They then made an excursion by land, struggling through the tangled forest on the right bank, and on February 23rd ascended one of the wooded hills on the flank of the valley, where they hoped to obtain a view into the upper basin of the river. As might have been expected, the result of this reconnaissance was very problematic. The most important feature that the two guides were able to descry from a tall tree, looking upstream, was a flat stretch, some 650 yards long, which they assumed to be the shore of a lake, without, however, actually seeing the surface of the water. As, moreover, they could perceive no more lofty mountains to the east, they supposed that they had the edge of the cordillera before them at a distance of three or four miles from their post of observation. Want of provisions, and the hopelessness of progressing rapidly forward over such difficult ground, forced the travellers to retrace their steps.

Vidal's expedition, and in particular the excursion of the two guides just referred to, affords a striking example of the inadequacy of journeys of investigation in which the travellers content themselves with following a stream of Western Patagonia as far as it is navigable, and then seeking

to obtain a glimpse of the oro-hydrography of the source-region from some forest-clad height on the flank of the valley.[1] Thus, to the Simpson expeditions, which were as barren of results as those of Vidal, is due the belief, quite indefensible in my opinion, that there are rivers, such as the Rio Aisen and Rio de los Huemules, which rise on the Patagonian plateau and make their way to the west through the whole breadth of the cordillera. So, too, since Vidal's report on the Puelo expedition, a large lake, the "Lago Puelo" has figured on maps in about the position where the travellers' march into the interior came to an end, and where they supposed themselves to be close to the limit of the cordillera towards the open pampa.

During the course of our journey it became apparent how superficial and inaccurate were the conceptions of the formation of the cordillera and the hydrography of the Upper Puelo acquired by the Vidal expedition. The fact was again confirmed that only from great heights, if possible above the forest limit, can any insight be obtained into the fundamental outlines of the orography of the country, while during the struggle across valley flats, often of great extent and covered with impenetrable forests, or when catching a glimpse of the country from lower elevations, the explorer is liable to be totally misled as to the direction and development of individual ranges, about the existence of large sheets of water, etc. Though, however, a "Lago Puelo" does not exist in the situation indicated by Captain Vidal, nevertheless the conclusion that the traveller arrived at as to the origin of the Rio Puelo, judging from the comparatively high temperature of the water of the main stream, the presence of large flocks of waterfowl and other signs, is correct, and was confirmed by the last expedition, for the Puelo is the drainage channel of a series of lakes running deep into the heart of the cordillera, which, however, could certainly not have been seen by Vidal's men. The largest of these lakes, which I have named Lago Superior, was some years ago visited from the east by officials of an English land company, and the Argentine traveller, Ramon Lista, saw it a few months before the advent of my expedition, and made it known through the press as the "Lago Nuevo"; but none of the explorers from the Argentine side knew for certain by which river the lake sent its surplus water to the sea.

To complete the investigations commenced in the summer of 1895, I received in January 1896 funds to execute a short exploration of the large northern tributary of the Puelo, the Rio Manso, to inquire into the extension of the Puelo basin towards the north, and to find out whether this river also flows down from the large valleys, so excellently adapted for colonisation, which lie to the west of the ranges forming the interoceanic watershed. Dr Carl Reiche accompanied the expedition in the capacity of naturalist.

The hydrographic region of the Puelo extends from east to west across rather more than a degree of longitude (71° 6′ to 72° 18′), while

[1] On this subject see Dr. F. Fonck's pertinent remarks in his *Introduccion a la orografía y geología de la region austral de Sud-América* (Valparaiso, 1893), p. 93, and my article, "Chile und Argentinien in der patagonischen Kordillere" (*Geogr. Zeitschrift*, i. 8, p. 439).

from north to south it spreads over rather less than a degree of latitude, (41° 30′ to 42° 20′ about). The Puelo is the largest affluent of the Reloncaví, and with its wide-spreading headwaters extends from the inhabited Chilian coast lands into the valleys of the cordillera, which are easily accessible from the pampa, and have recently been settled from the Argentine side; as regards the practical question of communication by water between the two slopes of the mountains, its valley is of prime importance. Stretching like a gigantic furrow from north-west to south-east, it intersects the broad central mass of the cordillera, built up chiefly of biotite, granite, and diorite, and admirably exemplifies the tendency to fissuring in a south-easterly direction already pointed out by Bodenbender and Siemiradzki, which probably prevails through the whole system of the Andes from Neuquen southwards as far, perhaps, as the Strait of Magellan. In all parts are observable most striking effects of the forces of erosion, which in this ever rainy climate of the west coast attain their greatest development. Yet the differentiation of the mountains into sharply modelled individual groups and masses, such as are seen on the lower Palena, is never so pronounced in the Puelo basin. But here, also, mountain crests, evidently continuous, though frequently intersected by ravines, may be distinguished, as, for instance, the Cordon de las Hualas, crowned with snowy peaks, which shuts in the valley of the lower Puelo on the south, the Cordon del Pico Alto, Cordon de la Sierra, de los Castillos, etc.

Along the route followed by our expedition from the coast to the continental watershed, the following principal sections of the valley may be distinguished, which are also repeated in the same order on the Rio Manso. Near the coast lies the broad lower valley, in some places as much as three miles across, and occupied by alluvial flats and lakes, through which the Puelo flows, and through which the river may be ascended except where its bed is obstructed by some of the larger rapids. Farther inland comes the region of narrows (*angosturas*), where the Puelo —and the Manso also—is for long distances confined in cañons formed by closely approaching rocks, so that the traveller can advance neither up the river, on account of the uninterrupted succession of leaps, rapids, and cascades, nor on the banks owing to the precipitous cliffs. The flanks of the mountains on either side offer, however, ample room for movement, often extending from above the lower cliffs, only a few hundred feet in height, which confine the bed of the river, up to the foot of the cordillera proper, in roomy, gently sloping, wooded plains (*llanadas*), which by suitable treatment might be converted into the finest grazing grounds (*potreros*).

Fires of enormous extent have from time to time destroyed the forest on both slopes beside the narrows of the Rio Puelo, and consequently the traveller has to pick his way through a chaos of half-burnt trunks lying in all directions, among which a luxuriant aftergrowth has already sprung up, consisting chiefly of *coligües*, *maquis*, *chauras*, etc. Here and there occur caldron-shaped expansions of the valley (called *corrales* by us) in the circuit of which, as well as in many parts of the *angosturas*, terraces rising in several steps one above another may plainly

be observed. These are evidently caused by erosion, and mark former levels of the river.

After passing the *angosturas* the traveller marches eastwards into the region of the upper lakes of the Puelo, the largest of which, the Lago Superior, has a hook-shaped outline. Its longer axis, lying from north-north-east to south-south-west, measures nearly eight miles, and a large arm stretches out westwards and a smaller to the east-north-east. The level of the lake lies, according to Dr. Krüger's measurements, 750 feet above the sea, and its depth is considerable—over 330 feet. The scenery in the neighbourhood is of remarkable beauty. This lake basin, sunk with hardly any banks in the rugged granitic mountains of the main cordillera, here attaining its maximum development, gives rise to the Rio Puelo, which commences its westward journey by forming large rapids. It is fed by two great tributaries, the Rio Turbio, which flows from the south-south-west out of a highland region still unexplored—perhaps, as Dr. Fonck suggests, from one of the Lagos de Cholila of Argentine maps; and the river known in Argentina as the Rio Quemquemtreu, which extends its domain far to the north and drains one of the largest eastern valleys of the cordillera alluded to above. We denote it by the name of Valle Nuevo, which we owe to a couple of Chilian colonists who settled there a few years ago.

It is a valley with singularly beautiful scenery, bounded on the west by a continuous succession of elevations covered with snow, bearing hanging glaciers, and rising in some places to a height of some 6500 feet. On the east the horizon is shut in by bare ranges, which occasionally indeed rise to the height of the snowline, but are interrupted by broad passes, to which the traveller ascends up the steps of the valley, which succeed one another with great regularity.

The exit from the Valle Nuevo to the open Patagonian plateau, that is, into a river basin drained into the Atlantic Ocean, is by no means so difficult as the passage of the *angosturas* and of certain secondary passes in the western part of the cordillera, but still a considerable ascent from the western side, and a descent on the eastern side, have to be encountered in crossing the interoceanic watershed. The *boquete* we visited, which parts the waters of the northern feeder of Lago Superior from those of the Rio Maitén, a stream belonging to the Chubut system, is a platform broken occasionally by caldron-shaped depressions, and lies 2790 feet above sea-level, 2035 feet above the surface of the lake that feeds the Puelo, and 1380 feet higher than the houses of the small settlement in Valle Nuevo.

This longitudinal valley stretches from north to south for a distance of at least thirty miles, but is divided into several branches by low ridges. Its most northern section is drained westwards by the Rio Manso of the Puelo basin. Though it lies within the shelter of huge masses of the cordillera, the Valle Nuevo receives very frequent rains, and snow fails not to appear in winter. The daily range of temperature is much greater than on the west coast; we several times noticed that water froze in the night, while at noon the thermometer rose in the shade above 86° F. (at the beginning of March). In the upper Rio

Manso valley Dr. Reiche observed how the vegetation changes its character with the increasing dryness towards the east. The epiphytic vegetation abundantly developed in the gloomy damp forests of foliage trees in the lower valley disappears, and forms protected by special adaptations against loss by exhalation (*Lippia*, etc.) take its place. A characteristic form is the prickly cushion of *Mulinum*, which covers large tracts, and spreads from the open Patagonian plateau over the passes of the watershed into the upper valleys. Both the Valle Nuevo and the upper Rio Manso valley present charming and very varied landscapes. The pampa-like fields of grass are broken by small woods of *Libocedrus Chilensis*, generally mingled with *Fagus Dombeyi*, *Lippia*, and pretty clumps of *Maitén* ; sometimes one marches for miles over steppes of tall *coiron* grass (*Festuca*), or wades through swampy meadows (*ñadis*), where *Cyperaceæ* form the chief part of the vegetation.

The fauna of these higher valleys is undoubtedly richer than that of the primeval forests of Chiloë. The spoor of the Andine stag or *Huemule* (*Cervus chilensis*) was frequently met with, and was found as far up as the region of the stunted *Raulí* bush and of eternal snow ; pumas also and foxes are numerous. In the heart of the cordillera lives a large herd of wild bulls and cows, which apparently have for tens of years inhabited the mountain forests, totally cut off from Chilian or Argentine *potreros*. Here and there appear slight traces of an earlier settlement of the Rio Manso valley ; now, however, the old Indian population has disappeared, and colonists from the Argentine side have only recently penetrated into this remote corner of the cordillera.

It is very desirable that the valley of the Rio Puelo, or, still better, that of the Rio Manso, should be studied with a view to the establishment of a line of communication with the lands on the Chubut or other neighbouring Argentine colonies, as has lately been done in the case of the pass of Pérez Rosales. Our expeditions have demonstrated that the upper Manso valley, as well as the wide pasture lands of the Valle Nuevo, are excellently adapted for agricultural colonies. A road running from the coast of the Boca de Reloncaví through the lower Puelo valley, over the hills skirting the Rio Manso and through the upper valley of this river, would have to cross only one ridge, with an elevation ranging from 4900 to 5250 feet, and would involve no insuperable difficulties of construction either on the ascent or descent. Its continuation through the upper Manso valley, and over the ranges of the watershed, would then be easily accomplished.

At the present time there remain in the Patagonian cordilleras a long series of hydrographical questions still awaiting solution. The farther the explorer advances southwards the more he meets with puzzling problems. But the unveiling of this wild lonely mountain region is hampered by very great difficulties ; only now and then does an adequately equipped expedition succeed in laying down a cross section through the whole breadth of the cordillera, while we are still far from a thorough conception of its orographical configuration, based on an exact geological and topographical survey.

NOTES ON THE GEOGRAPHY OF THE ARGENTINE REPUBLIC.[1]

By H. D. Hoskold, Director-General of the National Department of Mines and Geology, Buenos Aires.

The earliest information of the country now known as the Argentine Republic is due to Juan Diaz de Solis, who in 1508 discovered the mouth of the river Plate; a few years later, in 1526, Sebastian Cabot sailed for a considerable distance up the Parana. The fort which Cabot erected as a protection against the Indians, called on an old map in the possession of the writer—which will be referred to hereafter—Santo Spirito, or Torre de Cabot, was placed on the left bank of the river Plate, or as it was then termed, Rio de Paraguayr, and was situated in lat. 31° 4′.

The occupation of Paraguay, Parana, Uruguay, and that part of the continent now forming the Argentine and Bolivian Republics, by the Jesuit missionaries—the great civilisers of the Indians—did more to enlighten the world as to the importance and value of those inland regions than the work of all their predecessors. It is well known that they constructed maps of the various localities where they established stations; but the writer has not, unfortunately, obtained a sight of any referring to Argentina.

The oldest and most important map, known to the writer, which represents these regions in detail, was published in Paris in 1656, by N. Sanson de Abbeville, geographer to the king of France at that period. It embraces the territory between lat. 19° 15′ and 59° S., along a meridional arc of 39° 45′, and extends from east to west, over 112° of longitude, from the "Mer de Paraguayr" on the east to the "Sud Pacifique." The greatest breadth of land exhibited upon this map is apparently along a line drawn from a point on the coast of Brazil to the north of San Salvador de Todos os Santos in lat. 12° 20′ S., to a point on the western coast of Peru, also in lat. 12° 20′, and extends over 48° 50′ of longitude.

The river Plate, or Rio Paraguayr as it was termed in 1656, is exhibited as falling into the Mer de Paraguayr, at Cape San Antonio, a promontory marked to the south of Buenos Aires, in lat. 37°, not far from its true position. Buenos Aires is represented in lat. 33° 48′ S.; here was a Spanish fortress, together with a few other buildings, and the territory occupied by the Spanish colony at that period consisted of a very narrow strip of land upon the western bank of the river Plate, where a valiant tribe of Indians for a considerable period successfully resisted the encroachment of Europeans.

This colony, a narrow slip of land along the coast of Brazil, occupied by the Portuguese, the fort at Buenos Aires, and the land surrounding

[1] This paper was written for the Geographical Congress, 1895, in London, but was not received in time to be read. The changes which have taken place since then have necessitated a few trifling modifications, which are noted in their places.—Ed.

the Jesuit stations were almost the only European possessions, the remainder of the north-western, western, and southern portions of the South American continent, up to lat. 12° 12′, being, according to the map, occupied by various tribes of Indians.

Paraguayr, as it was then denominated, is represented as extending over the whole of the land now known as the Pampa, up to the mountain chains situated to the east of the Andes, and for a long distance northwards to the ancient limits of Brazil and Peru. On the north-west it touches Chile, and extends southwards as far as the "Terre Magellanicque." The continuation of the continent southwards is called "Patagono," and its extremity "Terre de Feu ou Isles Magellanicque." Cape Horn is placed in lat. 57° 42′ S., and the entrance to the Straits of Magellan in lat. 52° 12′. Various rivers are marked on both sides of the Rios de la Plata and Paraguay.

Don Samuel Lafone Quevedo published a map in 1883 showing the ancient boundaries of the territory belonging to the town of Londres (London) from 1633 to 1683, the site of which is now included in the province of Catamarca.

The extensive area of the modern Argentine Republic is bounded on the west by Chile and on the north by Bolivia. The frontiers are not yet exactly fixed, and will shortly be delineated by mixed commissions. On the north-east the Republic is separated from Paraguay by the rivers Paraguay and Parana.

The north-western boundary of Misiones, commencing on the river Parana in lat. 27° 22′ 30″ S. and long. 56° 2′ 30″ W., follows the tortuous windings of this river to a point in lat. 25° 35′ S. and long. 54° 30′ W. From this point the Argentine Republic claimed that the northern boundary line followed the windings of the river Y Guazú eastwards to the confluence of the river San Antonio-Guazú de Oyarvide, along which it ran southwards. This river joins the river Piquire Guazú, which falls into the river Uruguay, and the two formed the south-eastern limit of Misiones; but for a considerable time past a portion of the eastern area of Misiones had been claimed by Brazil, and the question was ultimately submitted to the arbitration of President Cleveland, of the United States of North America, who adopted the limits claimed by Brazil and apparently indicated in a treaty made between the Spanish and Portuguese Governments in 1750. Thus a considerable portion of Misiones has been lost to the Argentine Republic.

Henceforth, then, the eastern boundary of Misiones will commence on the south, where the river Pepiry-Guazú (Pepiry-Mini de Alvear) joins the river Uruguay in lat. about 27° 9′ S. and long. 53° 50′ W. The Rio Pepiry-Guazú rises in extensive mountain groups, the principal elevation of which appears to be in about 26° 12′ 50″ S. lat. and long. 53° 39′ W. From or near to this locality the mountain chains bear towards the north-west, and carry the boundary across the interval between the above river—the exact direction and distance being as yet undetermined—to a point in lat. 26° 7′ S. and long. 53° 44′ 30″ W. or thereabouts, where are the sources of the important river San Antonio. Winding in numerous curves and zigzags, the San Antonio flows on the

whole about N. 20° 30′ W. to its junction with the river Guazú, which is situated approximately in lat. 25° 34′ 30″ S. and long. 53° 59′ W.

The mountain chains in which these and other rivers, such as the Rio Uruguay, Aguaray-Guazú, Piray-Guazú, Paranay-Guazú, etc., rise, have yet to be explored.

The general configuration of these elevated regions is such that the Rio Pepiry-Guazú flows southwards until it falls into the river Uruguay, while the Rios Aguaray-Guazú, Piray-Guazú and Piray Mini run westwards, and the river San Antonio follows a direction of about 20° 30′ W. of N. The higher ridges of the mountain chains run in a south-easterly direction, such as the Sierra del Iman, from which branch off a multitude of offshoots intersected by deep gorges and possessing similar hydrographic systems.

The part of Misiones still retained by this country—and it is extensive—is, for the most part, mountainous, and much of it is covered by dense tropical forests. The land, however, is very valuable and productive. Vast quantities of gigantic plants yield a fibre which can be fabricated into a material equal to silk in fineness and durability. The territory possesses great interest, for, when it is properly explored, it is highly probable that important geological, mineralogical, as well as hydrographical discoveries will be made, and at no distant time Misiones will doubtless become a great commercial centre.

The south-eastern portion of the province of Corrientes and the eastern portion of Entre Rios are divided from the Republic of Uruguay by the river of that name to a point in lat. 33° 58′ S. and long. about 58° 23′ 30″ W. from where the river Uruguay falls into the river Plate. Thence the river Plate and the Atlantic Ocean bound the Republic as far south as Cape Dungeness, in lat. 52° 23′ 50″ S. and long. 68° 24′ 20″ W.

The Straits of Magellan territory was ceded to Chile by treaty. The remaining southern territory of the Republic, namely, part of Tierra del Fuego, commences at Espiritu Santo, in lat. 52° 40′ S. and long. 68° 34′ W. From this point the dividing line between the Argentine and Chilian territory runs directly southward to Beagle Channel.[1] Beyond this it proceeds eastward with many windings and then runs northwards to Cape San Diego, in lat. 54° 40′ S. and long. 65° 7′ W. The map published by the Geographical Institute of Buenos Aires shows the southern boundary line of the Argentine territory as traversing Beagle Channel eastward to lat. about 54° 56′ S. and long. 67° 18′ W., curving southward from this point so as to include Picton Island, New Island, and Staten Island.

It is very difficult to determine at present how the area of the Argentine Republic may be modified by the delineation of the boundary towards Chile. This boundary is now being traced, but it will not perhaps be transgressing the limits of propriety to make a few very general remarks on this most important question. The line will doubtless be regulated more or less by the position selected for the most northern

[1] This boundary was marked out by a Joint Commission in 1895.—Ed.

frontier station, from which it will proceed southward. At present this station is near to the Pass of San Francisco, in the north-west of the province of Catamarca, and is said to be situated in lat. about 26° 52′ S. and long. 68° 17′ W.

The map of the writer, published under the authority of the Argentine Government, by Messrs. Philip and Son, shows that the initial station is situated some eighteen leagues to the east of the old line, which has always been regarded as the boundary of the two Republics at this point. Competent authorities have calculated that this displacement alone will considerably reduce the area of the province of Catamarca in favour of Chile.[1]

The Andine provinces, in order from north to south, are Jujuy, Salta, Catamarca, La Rioja, San Juan, and Mendoza; then follows an immense extent of land or national territory, divided into what are termed *Gobernaciones*, such as Neuquen, Rio Negro, Chubut, Santa Cruz, and Tierra del Fuego. A considerable portion of the area of these provinces, etc., is covered with chains of mountains running parallel to one another, and generally from north to south, parallel to the cordillera on the east: between these ranges and groups of mountains exist various elevated plateaus of great extent. The elevated regions are broken up into a multitude of ramifications running in all directions, and between these yawn deep, precipitous gorges or ravines, where the rays of the sun do not penetrate to the bottom all the year round; the almost inaccessible rocky crags around, and the general surface, constitute some of the wildest and grandest scenery imaginable, only to be equalled in other mountainous regions of South America. The conditions of climate and the rarefied atmosphere are exceedingly favourable for scientific observations. The great Andes may be considered as the backbone of the South American continent, and in the Andine provinces also are various points of great elevation.

Province of Jujuy.

This province is the most northern of the Argentine Confederation; the capital, of the same name, is situated in lat. 24° 11′ S. and long. 65° 21′ 30″ W., at an altitude of 4144 feet above sea-level, and is distant 1015 miles from Buenos Aires.

On the north Jujuy borders on Bolivia, and its north-western portion on a tract of land recently ceded to this Republic by Bolivia. On all other sides it is surrounded by the province of Salta. The total area of the province is 19,760 square miles, and its population 49,543.[2] The greatest altitudes of the mountains, as far as recorded, range from 9680 feet at Estaca to 11,150 at Tagareta, and 18,000 in the Sierra Aguilar. The lowest spots known are in one of the valleys at Isla, near Carmen, 1480 feet, and at Quebracho, near the Rio Negro, where the altitude is

[1] In the Treaty of April last there is no stipulation regarding the removal of the San Francisco pillar.—Ed.

[2] These figures, as well as the areas and populations of the other provinces, are results of the last census, in May 1895.—Ed.

1300 feet. The province is rich in minerals, such as copper, silver, gold, lead, antimony, etc., some of which have been exploited.

Province of Salta.

The capital of the province, of the same name, is situated in lat. 24° 45′ 40″ S. and long. 65° 23′ 45″ W., and has an altitude of 3840 feet above sea-level, and is 974 miles from Buenos Aires. The province extends over an area of 63,168 square miles, and has a population of 118,138.

To the east of the province of Jujuy the province of Salta is limited by Bolivia, to the east and south-east by the Gobernaciones of Formosa and the Chaco, to the south by the provinces of Tucuman and Catamarca, and to the west by the tract of land previously referred to as recently ceded to this Republic by Bolivia.

The highest mountains are the Nevada de Cachi, 21,300 feet; Cuesta de Acay, 13,100 feet; and the Nevada de Acay, 15,700.

The lowest points are at Chilcas, 2260 feet; Rio de las Piedras, Miraflores, 2395 feet; and Rosario de la Frontera, 2431.

This is one of the most important of the northern provinces, being noted for its mineral wealth. Many mines of copper, gold, silver, lead, antimony, bismuth, and borates exist, some of which are exploited.

Province of Catamarca.

The capital of Catamarca is situated in lat. 28° 25′ S. and long. 65° 45′ W., and stands 1667 feet above sea-level. On the north the province touches the tract which was formerly Bolivian territory; to the north-east lie the provinces of Salta and Tucuman; then on the east follows the province of Cordoba, while La Rioja skirts it on the south and south-west, and Chile on the west. The area of 32,671 square miles is occupied by a population of 90,187. The mountain termed Cerro Nevada Boneti, situated in lat. 27° 55′ and long. 68° 53′, has an altitude of 19,700 feet. It is, however, disputed whether it belongs to this province or to La Rioja. Peñasco de Diego, in lat. 28° S. and long. 69° 17′ 30″ W., has an altitude of 20,100 feet.

Various mountain chains, almost parallel to one another and to the Andes on the west, cover a very large area. On the eastern side of the province are other ranges, of which one of the culminating points is Aconquija, situated in lat. 27° 20′ S. and long. 65° 50′ W., with an altitude of 15,394 feet. It is on the frontier line of Tucuman. The south-eastern part of the province is also very mountainous, the principal range being a southward continuation of the Sierra de Aconquija, called Sierra de Ambato. Another mountain elevation still farther to the east is the Sierra de Ancasti. The very extensive plain of Santa Maria separates the mountains of Capillitas from that part of the Sierra de Quilmes which is situated in this province. It is in the Sierra de Capillitas that the principal copper and silver mines are found; but a large number of

mineral deposits are scattered through nearly all the mountain chains of the province.

Several nearly level camps of great extent lie between the principal mountain groups, such as that extending from Fiambala—5020 feet above sea-level, and in lat. about 27° 53′, long. 67° 32′ 30″—to lat. 27° 6′ 30″ and long. 67° 45′. The soil of this camp, from Medanito northwards, consists of finely pulverised pumice or volcanic ash of great depth. On an old river-bed in this neighbourhood is exposed a thickness of 100 feet, and probably in other points it is much more. The camp is here covered with short, thorny shrubs or brushwood, and it is one of the most arid and inhospitable deserts in the Republic the writer has travelled over. The feet of the mules often sink several inches into the fine pumice powder at each step, which, together with the scorching rays of a tropical sun, makes travelling far from agreeable. On one occasion the writer was fourteen hours in crossing this plain. Much attention has been given to the cultivation of the vine, and a fine quality of wine is produced.

Province of La Rioja.

The town of this name, and the capital, is situated upon the edge of a very extensive plain or camp running into the province of Cordoba, and at the base of the mountain called Cerro de Velazco, in lat. about 29° 20′ S. and long. 67° 1′ 11″ W., and is 1650 feet above sea-level, and distant 764 miles from Buenos Aires. The province has an area of 31,621 square miles, and a population of 69,228.

One of the principal groups of mountains is that of Famatina, which, according to the map of the Geographical Institute of Buenos Aires, commences at Paganzo, in lat. about 30° 10′ S. and long. 67° 22′ 30″, extending northwards to 28° 28′ 31″ S. lat. To the west these mountains spread out to the margin of the great valleys of Vinchina and Hermosa, which extend to the northern extremity of the province, and southward to the provinces of San Juan and San Luis.

To the east of the Cerro Negro the valley or large plain of Famatina divides this group of mountains from the Cerro de Velazco, which from an open plain at the Colorados extends northwards to lat. 28° 32′ S. This cerro has an altitude of 11,500 feet, and from lat. 29° S. and long. 67° 23′ W. sends out its ramifications as far as long. 66° 30′. Its extreme eastern branch runs in a north-eastern direction to join the Cerro de Ambato in the province of Catamarca. On the western side of the valleys of Vinchina, Hermosa, etc., other mountain chains extend westwards to the cordillera, intersected by valleys such as those of Jagüel, Tambillos, Guandacol, etc.

The highest mountain in the Cerro de Famatina is the Nevado, 20,650 feet, situated in lat. 29° S. and long. 67° 40′ W. The Cerro Negro has an altitude of 14,760 feet, and the Cerro de la Mejicana is still higher.

The principal mining centre of the province is Chilecito, or Villa Argentina, in lat. 29° 8′ 30″ S. and long. 67° 39′ 30″ W.; it stands

3537 feet above sea-level, and is 768 miles from Buenos Aires. The great valley commencing to the north of the town of Famatina, upon which Chilecito is situated farther south, slopes southwards to the province of San Juan, as is shown by the levels, Nonogasta, seven and a half miles south of Chilecito, being 3117 feet above sea-level, and Vichigasta, twenty-one miles south of the same town, only 2789. Towards the south-eastern portion of the province other mountain groups occur, such as the Cerros de los Llanos, etc.

The principal silver mines occur in the Cerro Negro district, and those of gold, silver, and copper in the Cerro de la Mejicana, etc. etc. Nearly all the mountains of this province are metalliferous. Viticulture is carried on to a considerable extent, as also the breeding of stock.

Province of San Juan.

The town of San Juan, capital of the province, is situated on the western edge of a large plain, at about nine miles from the base of the range called Sierra de Zonda, in lat. 31° 31′ S. and long. 68° 30′ 30″ W., and at an elevation of 2090 feet above sea-level. The province extends over an area of 36,682 square miles, and has a population of 84,251. It borders the province of La Rioja on the north and north-east, San Luis on the south-east, and Mendoza on the south; to the west it skirts the cordillera. The height of the mountains ranges from 13,000 to 23,000 feet, and nearly the half of the province is covered with chains.

East of the principal mountain groups stretch almost level plains called *Travesias*, *e.g.* the Travesia del Bermejo to the east of the Sierra Pie de Palo, 8200 feet high, entirely surrounding the Cerro Blanco and Sierra de la Huerta, and extending to the limits of the provinces of San Luis and Mendoza, and from the town of San Juan northwards to the Travesia del Zanjon; still farther north it unites with the Travesia de Magna. It is also prolonged on both sides of the Rio Bermejo to the northern limits of the province, where it narrows to the west and joins the Travesia of Guandacol, in the province of La Rioja. To the west of the Sierra de Billicun lies the Travesia de Matagusanos, extending northwards until it meets the northern extension of the Travesia de Magna, and southwards to a point in lat. 31° 28′ S. and long. about 68° 45′ W. This travesia is joined by breaks in the mountains to others farther to the west, the principal of which commences on the Rio Castaño in lat. 31° 9′ S. and long. 69° 32′ N., extending northward to Palaca, 6890 feet above sea-level, in lat. 29° 27′ 30″ S. and long. 69° 24′ W. The greatest width of the travesia is from Guardia, at the base of the western mountains, to Iglesia, where it is twenty miles.

This is one of the most important of the Andine Federal provinces, possessing a large number of gold, silver, copper, and other mines, some of which are exploited. It has a very considerable area under cultivation, and much attention is given to viticulture and the raising of stock. It has some very large rivers, which become at times very rapid. Not long ago the town of San Juan and others in the province suffered from the effects of violent earthquakes.

Province of Mendoza.

This province skirts the cordilleras from San Juan down to the Gobernacion of Neuquen. The town of Mendoza, the capital, is situated in lat. 32° 53′ S. and long. 68° 48′ 55″ W., at an altitude of 2493 feet above sea-level. Its area is 57,203 square miles, and population 148,160. The highest mountain is the Aconcagua in lat. 32° 40′ S. and long. 69° 57′ 30″ W. Its height has been variously estimated. Pissis gives 22,913 feet; Guessfeldt, 22,867; Fitzroy, 22,939; Rechey, 22,913. Recent observations give 22,965 feet as the height.[1]

Ave-Lallemant—and there is no better authority—states that the position of the Pyramid in the Cerro Blanco de Paramillo is in lat. 32° 28′ 47·88″ and long. 69° 7′ 30·98″, and that its height is 9390 feet. Tupungato is placed in the map of the writer in lat. 33° 22′ S. and long. 69° 48′ W.; others, however, have given it a different position. Its height has been estimated at 22,000 feet; but, for the map referred to above, 20,300 was chosen as probably nearer the truth. The Cerro Overo, farther south, attains an elevation of 15,550 feet; the Cerro Colorado has an altitude of 6135 feet; and La Silla of 5938 feet.

This province contains immense plains such as Travesia Grande del Tunuyán, which runs northwards beyond the limits of the province into the province of San Juan, and southward to join the Pampa de la Varita, passing into the Gobernacion de la Pampa. Along the parallel of 34°, from the base of the Cerro Guadal and the Cerro Guaiqueria to the Rio Desaguadero, this plain has a width of 104 miles. More to the south, and between the mountains, other camps exist, such as Pampa del Sur and Pampa de la Matanzilla, and others.

Gold, silver, and copper deposits are to be found in nearly all the mountain ranges, some of which are being exploited, such as the mines of Uspallata. Petroleum also is obtained from the wells at Cacheuta, and there are seams of good coal in the department of San Rafael. Much attention is given to agriculture, viticulture, and cattle-breeding. The rivers of the province are rapid at certain seasons of the year.

Gobernacion del Neuquen.

The capital of this Gobernacion, or national territory, is Chosmalal, in lat. about 27° 26′ 45″ S. and long. 69° 50′ W. The town stands 2628 feet above sea-level. The territory lies between the province of Mendoza on the north, and the Gobernaciones of the Pampa Central and Rio Negro on the south and east, and skirts the cordillera on the west. It has an area of 35,685 square miles, the greater portion

[1] News has lately been received that Zurbriggen, the Swiss guide who is with Mr. FitzGerald, has reached the summit, and found it to be more than 24,000 feet above sea-level. Aconcagua is, then, the loftiest mountain in the New World, surpassing Mount Logan, and it is the highest peak in the whole World ever trod by the foot of man. Mr. FitzGerald was prevented by illness from ascending higher than 23,000 feet, but intended to make another attempt.—Ed.

being covered by mountains. The extinct volcano Copahué has an altitude of 13,000 feet, and its crater is occupied by a lake.

The region has not been thoroughly explored; but its lakes and hot springs and large rapid rivers are celebrated. Gold, silver, copper, lead, and coal mines abound, and the first-named metal is worked. The climate is exceedingly good, and the inhabitants devote themselves to agriculture and stock rearing.

Gobernacion del Rio Negro.

Situated between Neuquen and Pampa Central, Chubut, the province of Buenos Aires, the Atlantic Ocean, and Chile, it extends over an area of 80,067 square miles. Comparatively, it is not very mountainous; the principal elevations are situated between lat. 40° 35′ and 42° 30′, joining the cordillera on the west, and spreading to long. 70° 42′ 30″ W., and rising to heights of 40,350 to 8200 feet. Several lakes lie among the mountains and at their skirts. One of the principal is Lake Nahuel-Huapi, extending from lat. 40° 37′ 30″ to 41° 32′ 30″ S., and 2030 feet above sea-level. A large portion of this Gobernacion is arid, and is dotted over with hills of slight elevation. However, along the river valleys, and where water is found, the land is exceedingly fertile. Many parts are capable of irrigation and high cultivation, and are excellent for stock raising. To the extreme south-east is situated the Sierra General Roca, and, near to the coast, the Sierra Antonio. The mountains have not been scientifically explored.

Gobernacion del Chubut.

This territory stretches from the parallel of 42° to the Gobernacion of Santa Cruz on the south, and from the cordillera to the Atlantic Ocean. Its area is 96,175 square miles. Rawson, the capital, stands near the coast, in lat. 43° 18′ S. and long. 65° 15′ W., at a height of 279 feet above sea-level.

The principal colony has been formed by Welshmen, who cultivate a considerable area of land. From this locality westward is an extensive arid tract; the western part, however, is fertile, covered with strawberry fields and splendid grass, with fruit and forest trees, and is traversed by wide and rapid rivers. Near to the Andes it is very mountainous, the lower part being well wooded; but these regions have not been thoroughly and scientifically explored. One of the highest points is in lat. 42° 50′ and long. 72° 32′ 30″. Mount Yanteles also is 11,980 feet high. Towards the south the mountains decrease to about 3300 feet in height. Lakes Fontana and Musters are named after their discoverers. Expeditions organised to examine a portion of this territory have discovered gold and other mines. The colony 16th of October, in the north-western portion of the Gobernacion, was also founded by Welshmen who are engaged in agricultural pursuits. It is a fine grazing country, and many persons are engaged in raising stock. The principal produce in the original Welsh colony is wheat.

Gobernacion de Santa Cruz.

The boundary between this territory and the Chubut is marked by the parallel of 46° ; thence Santa Cruz extends southward to the parallel of 52° on the meridian of 70° ; the boundary line then passes round Cape Dungeness to the cordillera.

The western mountains diminish in breadth as they approach the Straits of Magellan. Mount Valentine, in lat. 43° 30′ and long. 73° 12′ 30″, has an altitude of 12,700 feet. Mount Stokes, in lat. 50° 30′ and long. 73° 8′, rises to 6400 feet, while Mount Payné, still further south, is only 5800.

In the northern portion of this territory, to the east of Mount Valentine, the Pico Sur has an altitude of 4660 feet ; and in lat. 48° 3′ and long. 72° 9′ stands Mount Belgrano with only 3800 feet, and Mount Morgan, in lat. 50° 30′ and long. 72° 12′, with 3250. And again, Mount Aymond, lat. 52° 16′ and long. 69° 20′, has an altitude of 1000 feet. Thus it is seen that the mountains diminish in height towards the south. In fact the whole surface slopes southward as well as eastward. The Gobernacion is well watered by various rivers ; the mountain regions have not been properly explored. The land is very fertile and adapted to agricultural and grazing purposes.

Gobernacion de la Tierra del Fuego.

The limits of this territory have been previously given. It extends over an area of 8038 square miles. Ushuaia is the chief town, and the seat of local government.

The late lamented explorer, Popper, made various discoveries in this region, the principal being gold washings along a portion of the coast. When the precious metal has been exhausted by the miner, the supply is renewed by the sea, which in tempestuous weather washes up on to the coast magnetic iron sands mixed with gold. Certain islands to the south, previously noted, are included in this Gobernacion.

The western part of Tierra del Fuego, in the possession of Chile, is very picturesque, the valleys being well supplied with water and timber. Here also a considerable quantity of gold is annually obtained.

The islands in the Straits of Magellan, as well as the mainland surrounding it, are covered with forests, which continue more or less northwards to the Gobernacion described above.

The Central and Eastern Federal Provinces are San Luis, Cordoba, Tucuman, Santiago del Estero, Santa Fé, Corrientes, Entre Rios, and Buenos Aires.

The Province of San Luis

is situated between those of San Juan, La Rioja, Cordoba, Mendoza, and the Gobernacion of the Pampa Central, extending over an area of 28,640

square miles, and with a population of 81,155. The north-eastern part is mountainous, and the highest point is considered to be Tomalasta, situated in lat. about 32° 49′, long. 66° 5′, with an estimated altitude of 6945 feet. The plains in this province, such as the Travesia Puntana and others, are of enormous extent.

The capital, San Luis, is situated at a distance of 478 miles from Buenos Aires. Seventeen miles west of the town a boring has been made for water, at a place called El Balde (1447 feet above sea-level), to a depth of 1970 feet, where a gravel bed was found, the water from which rose to the surface. It is a curious fact that all the rock bored through was indurated marl or mud, with a few thin bands of sand and gravel, and reddish friable sandstone of recent formation. Some auriferous deposits have been exploited, and there are other mines of gold, silver, copper, lead, manganese, and marble. Agricultural pursuits and grazing employ many of the inhabitants.

Province of Cordoba.

This is the most central province of the Republic, and is situated between those of San Luis, La Rioja, Santiago del Estero, Santa Fé, Buenos Aires, and the Gobernacion of the Pampa Central, extending over an area of 66,720 square miles, with a population of 351,745. The city of Cordoba is in lat. 31° 25′ 15″, and long. 64° 11′ 16″, and is 1440 feet above sea-level. The mountains of the province are situated, for the most part, between the parallels of lat. 29° 35′ and 33°, and in their widest part extend from long. 64° 7′ 30″ to 65° 30′. The highest summit recorded on the Institute map is Cerro Champaqui, 9350 feet. Oveja, in the Sierra Comechingones, is 7237 feet. Cerro Gigantes, farther to the north, has a height of 7710 feet; while the Cerro "Minas" does not exceed 5580 feet, and others are still lower. There are extensive plains here, some of which lie not more than 650 feet above sea-level. The lower hills are covered with trees, grass, etc.; the valleys are well watered, and the scenery very picturesque. As regards mines and farming, the same remarks apply to this as to the preceding province.

The Province of Tucuman,

situated between Catamarca, Salta, and Santiago del Estero, is the smallest of the Confederation, having an area of only 8482 square miles, with a population of 215,693.

In the north-west, from lat. 26° 5′ to 28°, Tucuman is very mountainous: on the western boundary stands the Sierra de Aconquija, referred to under Catamarca, and another range runs westward to the Sierra de Quilmes. The mountains diminish in height eastward. The altitude of the town of Tucuman is 1476 feet, and its distance from Buenos Aires is 786 miles. The railway from Tucuman, northwards, rises to an altitude of 2700 feet at the station Tala.

The cultivation of the sugar-cane is carried on to a large extent, and

other agricultural pursuits are extensively developed. Part of the province is covered by forests and exceedingly well watered. Several of the mines of gold, silver, and copper were worked in ancient times, but no mining industry is at present carried on.

Province of Santiago del Estero.

Lying east of Tucuman and Catamarca, between Salta and the Gobernacion del Chaco on the north, and Cordoba on the south, the province includes an area of 36,138 square miles, with a population of 160,445. The town of Santiago is situated in lat. 27° 48′ 2″ and long. 64° 15′ 2″, at a distance from Buenos Aires of 745 miles, and stands 610 feet above sea-level.

With the exception of the Sierra de Guasayan, and the Cerros Colorados, Ambargasta, and Sumampa—the culminating point of which is only 600 feet high—there are no mountains of any extent. Most of the province consists of almost level plains, partly salt pans (*Salinas*). Forests cover the border towards the Gobernacion del Chaco. The land is rendered exceedingly fertile by a system of irrigation. Viticulture and sugar-cane industries are considerably developed. Large quantities of wheat and Indian corn, clover and tobacco are produced. No traces of ores have been discovered, but marble and sandstone occur in abundance. One of the largest meteorites in the world is to be seen in this province.

Province of Santa Fé.

This province lies to the west of Santiago del Estero, and is bounded on the east by the river Parana. It has an area of 51,080 square miles. The port Rosario, on the Rio Parana, stands in lat. 32° 56′ 41″ and long. 60° 39′ 3″ W., and is 128 feet above sea-level. A large amount of shipping visits the port, and the province is noted for its numerous and prosperous settlements. Agriculture and cattle-breeding are the chief industries. A large quantity of grain and wool is annually exported. There are no mountains in this province. Whether it contains minerals is yet unknown.

Province of Corrientes.

South of the Parana, which divides it from the Republic of Paraguay, lies Corrientes, extending to the river Uruguay on the east, covering an area of 32,879 square miles, and inhabited by 239,570 souls. The capital is in lat. 27° 27′ 55″ and long. 58° 49′ 6″, at an elevation of 220 feet above sea-level. The principal products are sugar, corn, wool, and clover.

The country is almost level, with lakes in the lowest parts.

Province of Entre Rios.

To the south, Corrientes is succeeded by Entre Rios, lying, as its name implies, between two rivers, the Parana and the Uruguay. It has an area

of 2863 square miles and a population of 290,994. The surface is undulating, and water is abundant, the province being in this respect one of the most favoured. The town of Parana is in lat. 31° 43′ 45″ and long. 60° 31′ 19″. Small steamers run daily from this town to Rosario. Agriculture is the principal industry.

Province of Buenos Aires.

This large and important province, with a long Atlantic sea-board, and extending down to the Rio Negro Gobernacion, has an area of 117,262 square miles, and a population of 1,585,079 (Buenos Aires city included).

Buenos Aires, the capital and seat of the national Government of the Argentine Republic, is the great maritime port. The geographical position of this city has been variously calculated. Ten authorities have fixed the lat. from 34° 36′ to 34° 36′ 29·8″ and the long. from 58° 16′ 19″ to 58° 23′ 24″; but the director of the National Observatory of Cordoba, Dr. Thome, gives the lat. at 34° 36′ 31·4″ and the long. at 58° 22′ 15″ west of Greenwich. The city has an elevation of sixty-six feet above the sea-level. All the principal towns of the Republic are in communication with Buenos Aires by railway and telegraph lines. It is an agricultural province, producing an abundance of grain, stock, wool, and all kinds of vegetables and fruits. The chief town of the province is La Plata, where there is a fine port.

A few other extensive but thinly populated districts remain to be noticed. First there is the

Pampa Central,

covering an area of 56,336 square miles to the west of the province of Buenos Aires. General Acha, the capital, is situated in lat. 37° 22′ 30″ and long. 64° 39′ 30″, and is 732 feet above sea-level.

The surface of the Gobernacion is undulating, and in part covered with woods, low hills, and fertile camps and valleys. Limited areas are cultivated, and stock is raised. Lakes have been formed in the depressed parts, a few of which are saline.

The mountains are only 7200 to 7700 feet high. Copper ore has been discovered and some mines opened, but the commercial value of these is still uncertain.

Gobernacion of Formosa.

At the north-eastern limit of the Republic, and bordering on Paraguay, is the Formosa territory, 45,560 square miles in area. The town of Formosa is situated in lat. 26° 12′ 40″ and long. 58° 4′ 50″; authorities, however, differ slightly in reference to the position. The altitude above sea-level is 121 feet.

A portion of this territory is well watered by rivers and susceptible of high cultivation. A considerable area is covered by forest.

The Gobernacion del Chaco,

south-west of Formosa, extends over an area of 53,328 square miles. Forests are spread over an extensive area of this Gobernacion, and companies are utilising the timber. Minerals are not known to exist either in Formosa or the Chaco.

The Argentine Republic contains fourteen federal provinces, each having a local government of its own, and nine Gobernaciones or National Territories under the direct control of the National Government. According to recent data, the total area of the Republic is 1,111,079 square miles and the population 4,043,000 (1895).

The central Pampean regions are devoid of forests in the proper sense of the term, but a good deal of useful timber is scattered here and there through the Andine and northern provinces; the uncultivated camps for the most part produce only brushwood here and there.

The great forests are to be found in the Gobernaciones of Misiones, the Chaco, and part of Formosa, as also in the low level camps which run parallel with the higher mountains in the Andine Gobernaciones, extending, with some breaks here and there, to the extreme southern portion of the Argentine and Chilian territories. In a few places the mountain chains are broken up by deep gorges in which rivers run, and along their slopes are large areas of land susceptible of high cultivation and generally covered with forest trees.

Twenty-nine passes have been recorded as penetrating the mountain ranges from Argentine territory through the Andes towards Chile. They are distributed throughout the range from the extreme northern to the southern boundary of the Republic, and their altitudes range from 2700 to 15,000 feet; few, however, are used.

The Malvina or Falkland Islands are always placed upon Argentine maps as claimed by this Republic, although they are still occupied by the English.

Although nearly all the territory of the Argentine Republic lies in the temperate zone, still its general configuration, taken in connection with its great meridional extension, points to the conclusion that there is a considerable variation of climate within its limits. The temperature in Buenos Aires during the winter months cannot be considered severe, nor the summer season oppressively hot, except for a few days at a time, owing to the influence of the river Plate and the Atlantic Ocean; but if we were to travel westward in the same parallel of latitude, we should at length cross some of the higher mountains in the province of Mendoza, where, during the winter season, the cold is intense, while the heat of summer is modified by the height and the currents of air. Hence almost any desired climate and temperature may be secured.

Many of the larger open and unprotected camps, or elevated plateaus, previously described as running north and south, parallel with the mountain chains, have a soil of pulverised sand mixed with alluvial earth, and sometimes fine pumice or volcanic ash, and during the hot season the

heat, accumulating here from the rays of a tropical sun, is so intense that travelling is far from agreeable, nay, even dangerous. The early morning is generally selected by travellers.

The Republic may be divided into three great zones, namely, the littoral, including Buenos Aires, Santa Fé, Entre Rios, and Corrientes; the middle Pampean and extreme northern and southern camps; and the great elevated Andine region.

Geodetical operations have not yet been instituted in a systematical manner in the Republic; consequently some of the geographical positions which have been given may be slightly in error.

This paper is only intended to deal with some of the more prominent geographical features of this great country, and therefore minute details have been avoided.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

New Members.

At a meeting of Council held on January 11th, the following ladies and gentlemen were elected Members of the Society :—

Cockburn, Miss.
Dalmahoy, Miss F.
Davidson, Miss M. A.
Gray, Mrs. A. R.
Stewart, Miss E. S.
Allan, Jas. A.
Bruce, Patrick C.
Gavin, Robt. D.
Luke, Dr. Jas.
M'Gregor, A. Wallace.
Matthew, P. M.
Mavor, Henry A.
Murdoch, Thomas.
Murray, Andrew.
Murray, John.
Stewart, R. K.
Verney, J. Hope Lloyd.
Watson, Charles.
Watson, Richd. M.
Watt, James.
Webster, J. H. D.
Wylie, Robert.

—In all twenty-two.

Lectures delivered in January.

In Edinburgh, on January 14th, Commander A. F. Balfour, R.N., delivered a lecture entitled, "Remarks on a Surveying Cruise in the Solomon Islands, 1893-94." Professor Geikie presided.

On January 18th Commander Balfour addressed the Glasgow Branch, the Chair being taken by Mr. Robert S. Allan.

Dr. Zaytoun lectured in Edinburgh, on January 28th, on "Cape Juby and the Western Sahara." Viscount Dalrymple was the Chairman.

On January 27th Dr. Zaytoun addressed the Aberdeen Branch on the same subject, on which occasion Mr. James Spence presided.

The first set of three lectures on the "Unity of the Empire," by Professor John Kirkpatrick, LL.D., were delivered in the Society's Hall.

Lectures in February.

As already announced, Dr. Nansen will lecture in Edinburgh and at the Branches on the following dates:—Edinburgh, February 12th; Glasgow, February 15th; Dundee, February 17th; and Aberdeen, February 18th. The time of meeting will be 8.30 P.M. at Edinburgh, and 8 P.M. at the Branches.

A banquet will take place in the Waterloo Rooms, Edinburgh, on February 13th.

It is expected that Mr. L. B. Clarence, late judge in the Ceylon Supreme Court, will give a description of the island in Edinburgh, on February 25th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

North-Eastern Iceland.—A report is given of Dr. Thoroddsen's journey in the summer of 1895 in *Petermanns Mitt.*, Bd. xlii. No. 12. To the north of the mighty volcanic region near the Myvatn comparatively flat country stretches out towards the north, terminating in three peninsulas. The most westerly, the Tjörnes peninsula, is marked by the occurrence of Pliocene marine deposits, rich in shells, to the north of Husavik. The middle one, Melrákki, crosses the Arctic Circle, and consequently is the most northern part of the whole island, while the peninsula of Lánganes, on the east, projects thirty miles into the sea, with a smaller breadth. Dr. Thoroddsen started from Akureyri on the Öfjord, and visited first the volcanic region of the Axarfjördhr, the centre of which is occupied by the volcano Theistareykjabunga. Solfataras and fumaroles abound here. The volcano rises only 200 feet above the surrounding lava flows, which are about 1600 feet above sea-level, and has the form of a flat dome, with a slope of only 1° towards the west and 4° to 5° towards the east. In the middle is a large caldron-shaped crater, two to two and a half miles long by half a mile broad. To the south stands another smaller volcano, Storaviti, also with a very slight declivity. The lava has poured out on all sides, reaching northwards nearly to the shores of the Axarfjördhr. Dr. Thoroddsen then marched northward to the delta of the Jökulsá, where he found, as in other districts of this corner of Iceland, that the substratum was composed of preglacial dolerite. A strand line 130 feet above sea-level showed that in post-glacial times the country round the mouth of the river was still under water. In the western part it consists of a gently undulating plateau 600 to 1600 feet high, from which three isolated mountains rise to a height of 1700 feet. Two of these have flat tops, while the third, the Thverárhorn, is surmounted by a rocky pinnacle.

The interior of the Melrákki peninsula is a plateau sinking very gently northwards and studded with numerous large and small lakes, more or less silted up. Drift ice from Greenland often lies off the coast for months together during the summer, and brings snow and cold weather with it. The temperature is always cool in summer, and even when there was no ice to be seen, and the sky was clear, the traveller found that the mean temperature was never above 45° or 46° F., and often only 41°. When there is much ice the ground is often frozen throughout the summer to a depth of one and a half to two feet. Brown and white foxes are plentiful, and from them the peninsula derives its name. Bears, too, often come with the drift

ice, but are immediately killed by the natives. Forty or fifty years ago drift timber was cast ashore in such quantities that the people not only obtained enough for their own needs, but sold wood to their neighbours farther inland. Now they have to dig up half decayed trunks out of the sand and dry them for fuel.

On July 22nd Dr. Thoroddsen reached the north-western extremity of Melrákki, the peninsula Rádnagnupr, a dolerite dome sinking steeply to the sea. It owes its name, "Red Dome," to a thick layer of red ashes between the strata of dolerite, which proves that a preglacial volcano must have existed in the immediate neighbourhood. The most northerly point of the peninsula, Rifstangi, is a mass of dolerite blocks, and the whole country is somewhat monotonous as far as Ormalon, where hills of tuff terminate on the shore in steep cliffs. To the south the vegetation is singularly luxuriant, and the country seems well suited for sheep farming. Years ago there were many farms here, but a few bad years drove the inhabitants to emigration, and much labour, capital and perseverance would be needed to restore the land to its former condition. Along the flat land on the south coast of the Thistilfjördhr, Dr. Thoroddsen came to the peninsula of Lánganes. Its northern coast consists entirely of preglacial lava, across which three hills of tuff run from north to south. From the contraction between Heidi and Eidisvik only dolerite is seen, breaking off in steep cliffs at the water's edge. On Lánganes, also, layers of red ashes give evidence of the former existence of volcanoes, and at the southern end, by the Finnafjördhr, were seen well marked terraces and driftwood far above the present sea-level, and at the Nypsfjördhr the same signs of elevation were noticed.

From the latter point Dr. Thoroddsen turned westwards through a country never before explored topographically and geologically. From Vidiholl he made an excursion northwards to the Burfellsheidi, the escarpment of the inland plateau, whence a number of streams run parallel to one another to the Thistilfjördhr. The view from the tuff mountain Burfell embraced a wide region; the most striking feature was a succession of lakes lying to the north on the preglacial lava. Thence over a pathless country where rocky ridges alternate with almost impassable morasses, and across the ridge of Hvannstadafjöll, with its innumerable fissures, Dr. Thoroddsen returned to the Jökulsá. He also visited the volcano Raudhólar, south of Melrákki, a row of craters lying N. 36° E., and the Vikingavatn, a beautiful lake at the edge of the Reikaheidi, a lava region subject to frequent and violent earthquakes.

The scientific results of this journey are very important. The most striking discovery is that the region of recent volcanic action, which from the neighbourhood of Myvatn southwards as far as Vatnajökull, separates the West and East Icelandic basalt formation, extends northwards to the sea, and that the basalt formation is here only found isolated in a part of Tjörnes. The whole country is a huge field of subsidence bounded on the west by a fault with a considerable throw. The basalt has here sunk down, and huge quantities of breccia, tuffs, and lava have been raised up. The whole of North-east Iceland bears traces of glaciation, but the inland ice seems to have exerted comparatively slight eroding action.

Russian Industries.—In connection with the exhibition held last year at Nizhni-Novgorod, some details are given in the *Bull. de la Soc. de. Géogr. Comm. de Paris*, No. 6, 1896, of the natural and artificial products of Russia. Agriculture and its dependent industries employ 80 to 100 millions of the inhabitants of Russia. The wheat crop of 1895, represented in the exhibition by a coffer on the scale of one to a million, was 40,305,000 tons. In the Ural mountains there are 108 smelting-houses, and during the past thirteen years the mining industry in Russia

has made great strides. In 1895 nearly 7½ million tons of coal were extracted, while in 1860 the quantity was only 290,000. The production of petroleum has increased from 339,000 tons in 1880 to over 5½ millions in 1895. Gold-mining is making a fresh start, and more perfect processes are being employed. The yield in 1895 was 103,998 lbs. troy, valued at £5,287,880. The production of copper has been doubled since 1882—in the Caucasus, where electricity has been employed, it has been trebled. Mercury, which did not appear in the Moscow exhibition of 1882, is now exported from the steppes in considerable quantities. Iron-founding has made gigantic strides, partly through the introduction of foreign capital. The metal is now worked in 180 factories in different parts of Russia, and the production of the whole empire, including Siberia and Finland, now amounts to more than 1431 thousands of tons of cast iron, nearly 458 thousands of wrought iron, and over 565 thousands of steel. The total export of iron in all forms, including machines, etc., is fully 360 thousand tons, while the iron used annually in Russia itself is a little more than 4½ cwt. per inhabitant. A comparison of the figures for the last three years shows that the home industry has progressed at the expense of importation.

In other industries, also, great progress has been made since 1882. In cotton-spinning Russia occupies the third place, after Great Britain and the United States. Not only is the home demand supplied, but goods are manufactured for exportation to the East. New methods have been introduced, and fine threads are now manufactured. Equally flourishing are the wool manufactures.

The Island of Cos.—This is the nearest of the Cyclades to Attica, being only twelve nautical miles from Cape Sunium. Between it and the mainland lies the long narrow rock of Makronisi, forming two straits, of which the one near Cos is used by vessels sailing from the Mediterranean to the Black Sea. To the south is seen Cynthos (Thermia), at a distance of five miles. From the port of Cos to the Piræus is forty-two miles, and to Syra thirty-eight miles. The name has assumed many forms during the course of centuries; the island is now styled Kea in official deeds, while the Athenian purist retains the form Keos.

The island has an oval form with its longer axis lying north-east and south-west. Its length is 10 miles, and its greatest breadth about 5¼. Its perimeter measures 25½ nautical miles, and its surface about 32⅓ square miles. Though not containing any regular chains of elevations, or any summits of great height, the island of Cos deserves to be called mountainous. The whole of it is undulating, without any sharp peaks or steep cliffs. Nothing but the groves of oak, which cover the greater part of the island, and a few plantations of lemon-trees, stands out sharply against the sky. Of all the elevations three summits are conspicuous. They stand on the same foundation, succeeding one another from north to south. The most celebrated is the mountain of the Prophet Elias, 1864 feet high, on which is built a chapel in honour of the saint, and where a fine view may be obtained, embracing several of the Cyclades, the mountains of Attica, Eubœa, and Argolis. The hillocks around are well cultivated, oaks and vines grow splendidly, and on the east is seen a fine plantation of chestnuts.

Towards the centre of the island stands the Mount Saint Pantaleon, and towards the southern extremity Mount Saint Theodore. South of the latter lies a stony, sterile country called by the natives Petrussa, where not an oak, however stunted and miserable, is to be found. Another mountain, Saint Simeon, lies to the east. All the mountains are named after saints, and are crowned with chapels which were originally Greek temples.

The whole coast is much indented. The most northern inlet is the Gulf of Otzia,

with a length of 6½ furlongs and an average depth of 20 fathoms, and on the north-west is the Gulf of St. Nicolas, the principal port of the island, and one of the largest and safest in the Cyclades. The most remarkable promontory is Cape Amilion, the southern extremity. Projecting into the sea, it attracts the eye of the sailor by its mass of precipitous rocks and the geologist by its structure and the different colours of its component strata. The name Tamelos, given to it by foreign geographers, is a corruption, in which the article has been fused together with the real name. Owing to its hilly character, Cos has neither plains nor plateaus. Here and there on the slopes occur a few flat patches, which are well cultivated when they are protected from torrents. The largest valley is that of Pisais, running from the north of the ancient Piiessa and terminating at the Gulf of Pigania. Cotton and vegetables are cultivated here, and a few vines grow on the bottom; neither trees nor water are to be found. The valley of Livadia is equally bare, containing only a few vines and fig-trees, except where the inhabitants cultivate small gardens with the aid of water drawn from wells. In the valley of Otzia there is more verdure, and vines, watered from small springs, produce an agreeable wine.

In ancient times Cos was noted as a well-watered island, and it is certain that many springs, now dried up, irrigated pasturage where fed the large flocks mentioned by Virgil. The Elixus is now the chief stream. Rising in the mountain before the town of Cos, it receives some other small brooks and flows into the Gulf of St. Nicolas, forming insignificant marshes which sometimes engender fevers. Of the others Phlea, near the capital, and Vrysais, on the east of Mount Simeon, are the most important.

Geologically Cos is a prolongation of Attica, and, in particular, of Laurium. The rocks are alternating schists and limestones, and at their planes of contact are found deposits of iron and galena, none of which is now exploited. In ancient times red lead was extracted from caves at Stoncalamo and Saint Martin, but now the mouths of these caves are closed by soil and pebbles washed down by the rain. For many years agriculture has been the principal industry. The land is divided into small holdings, and while the system has prevented poverty it has also been an obstacle to the improvement of the soil. Little has been done to intensify cultivation or to promote commerce and agriculture. Most of the inhabitants are content with the relatively high prices they obtain for their valonia, wine, barley, and cattle, and follow exactly in the steps of their forefathers. Since 1866, when a Cretan refugee introduced the arts of dyeing and weaving, the cultivation of cotton has somewhat increased, and several girls have learned the most modern processes of cotton manufacture in the factories of Athens and the Piræus. The olive is little cultivated, and the fig-trees are rare and poor. The wine, on the other hand, is abundant and of excellent quality, and 370 tons, valued at £1200, are exported annually. The chief source of wealth, however, is valonia. The oaks cover most of the island, except Petrussa and some rocky hills near the coast, and yield the natives an average annual revenue of £12,000. Sheep, goats, pigs, mules, and asses are also numerous, and the export of animals produces a sum of over £4000 annually.

The inhabitants number more than 5000, and are almost all Greeks. They are in general kind and affable, generous, light-hearted, and courageous, and make good sailors and soldiers.—M. H. Hauttecœur in the *Bull. de la Soc. R. Belge de Geographie*, No. 3, 1896.

ASIA.

New Railway in the Caucasus.—A connection between the Transcaucasian Railway and the network of Russia has been long talked of. This was to be effected by a line from Vladikavhaz to Tiflis. It has been found, however, that great engineering difficulties and great expense would have to be met on this route, and therefore, as M. Daniel Bellet reports, it has been decided to carry a line round the central mass of the mountains, the eastern side having been chosen. A *ukase* has been signed authorising the construction of a railway between Petrovsk and Baku, passing through Derbent, which, to avoid as much as possible the difficulties of the ground, will follow pretty closely the shore of the Caspian Sea. Its length will be 252 miles. The work was to be commenced last July—at any rate on the section of ninty-three miles between Petrovsk and Derbent, and this section will probably be completed early this year. The section from Derbent to Baku will probably be finished within the year. The line will be an important means of transport for merchandise from Persia and for the petroleum of Baku, particularly to the rising port of Novorossiisk.—*Comptes Rendus* of the Paris Geographical Society, Nos. 15 and 16, 1896.

The Population of the Chinese Empire.—M. P. C. Popof, who years ago published in the *Novoie Vremia* an article on the population of China in 1882, has given in the *Izvestiya* of the Russian Geogr. Soc., No. 3, 1896, the figures for the year 1894, which he obtained through the assistance of Yan I-chi, the secretary of the Chinese Foreign Office. The following is an extract from his table :—

Province.	Population.	Area in sq. miles.	Density per sq. mile.
Shan-tung,	34,437,672	65,104	576
Shan-si,	11,050,764	56,268	195
Ho-nan,	22,120,648	65,104	340
Kiang-su,	21,974,089	44,500	490
Kiang-si,	24,598,915	72,176	340
Che-kiang,	11,842,656	39,150	302
Hu-pei,	34,339,524	70,450	487
Hu-nan,	21,009,977	74,320	282
Shen-si,	8,473,045	67,400	126
Sz'-Chuen,	79,493,058	166,800	476
Kwang-tung,	29,852,112	79,456	376
Kwei-chau,	4,840,900	64,554	75
Kirin,	626,232	?	
Fu-kien,	25,235,184	53,480	500
Mukden,	4,724,674	?	
Ngan-hwei,	35,810,000	48,461	739
Yun-nan,	6,114,150	107,969	56
Kwang-si,	8,527,378	78,250	109
Kan-su,	9,750,645	86,608	112
Chi-li,	29,400,000	58,949	500
Hsin-kiang,	1,286,583	?	
He-lung-kiang,	400,000	?	
	428,908,206		

Some of the above figures have been in part estimated, for actual returns were only available for fourteen provinces. Of one of these, Mukden, the return was

incomplete, the population of certain towns not being included owing to the Japanese invasion. For the provinces Ngan-hwei, Yun-nan, Kwang-si, Kan-su, and Chi-li, also, the populations in 1894 are unknown. The following method was therefore adopted by M. Popof. As in ten provinces of China proper the population increased by five per cent. in the twelve years, 1882 to 1894, and as the conditions of life in them during the period has not differed materially from those in the five provinces enumerated above, it was assumed that five per cent. must be the utmost increase in the latter. Accordingly, the figures given in the assessment lists of 1881 were increased in this proportion. A similar process was applied to the population of Shen-king in 1887, and to that of He-lung-kiang in 1890. The average increase is very small, being only a half per cent. annually.

AMERICA.

Florida.—The Rev. John N. MacGonigle describes this peninsula in the *National Geographic Magazine* for December. Its geology is simple ; immediately below the surface, through the entire length of the State, lies limestone, doubtless of the Eocene system, which abounds in sink-holes and subterranean streams. The peninsula falls into three divisions—the middle portion, comprising the beautiful lake region, the west coast sloping from the high central ridge to the Gulf of Mexico, and the east coast with great sandy levels. Middle Florida is a broad ridge rising in places to a height of nearly 250 feet. The soil is in general sandy, but contains enough phosphate to make it fertile. Forests of pine grow in all parts, with an occasional cypress swamp or a palmetto grove. But the most striking feature is the lakes ; between Gainesville on the north and Lake Okeechobee on the south there are at a moderate estimate 30,000. They are not formed by surface drainage, or by the expansion of sluggish streams, but draw their supplies from the limestone by subterranean channels. Great springs, such as the famous Silver, De Leon, and Blue springs exist in this region. The west coast region is traversed by rivers of surpassing beauty, which rise in swamps and make endless windings on their way to the Gulf. The best known is the Suwanee, which rises at the edge of the Okefenokee swamp in Georgia, and enters the Gulf after a course of 240 miles. Along the banks and in the beds of these streams are the great phosphate deposits which constitute one of Florida's chief sources of wealth. Hundreds of tons are carried annually to Tampa, Punta Gorda, and Fernandina for export. The coast on the Gulf is indented by numerous bays, dotted over with tropical islands, where the verdure of the shores and the blue of the water are equally vivid. Tampa bay and Charlotte harbour are the chief inlets, and are the termini of two railways ; they are in communication by steamer with the West Indies and South America.

Between the middle lake region and the east coast lies the St. John's river. With its headwaters less than ten miles from the great lagoon in Halpatiskee swamp, it runs southward at a distance of never more than thirty miles from the coast, sometimes expanding into great sheets of water like Lake George, fifteen miles by five. Its chief tributary, the Oklawaha, winding among masses of vegetation and floating islands, presents a succession of beautiful vistas. The coast proper is formed by the coquina ledge, which extends all the way from Anastasia island to the southern end of Palm beach, enclosing the great lagoon. This is known under various names, its extreme northern extension being known as North river, which is followed by the Matanzas ; its southern limit is in Lake Worth, unless it should afterwards be discovered that the coquina ledge extends to Cape Florida, in which case Boca Raton, New River inlet, and Dumbfoundling bay will have to be included.

in the lagoon. A channel sixty feet wide and six feet deep having been recently dredged between the sections of the lagoon, it is now possible to enter at St. Augustine and steam in a launch all the way to Bay Biscayne.

Oranges are, it is well known, the chief vegetable product of the peninsula. The crop of 1893-94 reached 5,500,000 boxes. Hoar frost killed ninety per cent. of the trees, but sixty per cent. of these grew up again from the roots, and in three years the yield will probably again reach five million boxes. Next comes the pineapple, of which probably 80,000 crates were shipped last year. The middle region is an excellent sanatorium for pulmonary diseases, while the east coast affords relief in cases of nervous exhaustion.

In March 1892, Mr. J. E. Ingraham organised an expedition to explore the Everglades, two great basins lying between Lake Okeechobee and the southern extremity of the peninsula. They are doubtless formed by a prolongation of the rock composing the central ridge of the State. To the north the water flows into the Lake Okeechobee, and to the south through various rivers into the Atlantic and the Gulf. The rainfall over this vast area of three million acres possibly averages ten inches a month during June, July, and August, but the quantity of water is so great that the rain must be supplemented by water from springs, as, indeed, is probable from the conditions of other parts of Florida. From the east and west the water gradually deepens towards the middle of the glades at the rate of about 6·8 inches to the mile, filling a valley running north and south, in which the rock lies fifteen feet below the surface. Over the rock lies a soft peat or ooze, the product of vegetation decaying through ages, to a depth varying from a few inches to five feet, which, if ever drained, will yield a soil of great fertility. Throughout the basin, and to the east and west, stretches an almost impassable prairie of saw-grass, which grows to an enormous size. It resembles a bamboo pole, and on three sides bears very sharp teeth, sometimes an inch in length. It can easily be imagined that to travel through this grass is neither easy nor pleasant. The Indian, to whom time is no object, follows the leads of open water, which are as familiar to him as the streets to the inhabitants of a town. The Seminole Indians have long inhabited the Everglades. They grow bananas, sweet potatoes, and other vegetables on the higher and more fertile islands, and are fairly industrious, leaving their work only to hunt and attend the dances of their tribe. The women have no other work but to attend to their children and manage the household. As the tribe is diminishing, the game is becoming plentiful. Deer, bear, and wild turkey are found in fair quantities, and countless herons and ducks make their home on the islands. The average distance from the edge of the glades to the coast is about fifteen miles to the south and south-west, six miles on the east, and fifty on the west. West of the glades lie the Okaloocoochee solugh and the Big Cypress swamp.

To the south-west and south lies a country where exploration is difficult, and which is to a great extent unknown. Low lands lie along the large rivers and are subject to floods in spring. The banks are covered with black and red mangroves, fifty to seventy-five feet in height, and twenty-four to thirty inches in diameter. Off the coast, and extending to the north-west for many miles, are countless islands or keys, fringed with a dense growth of mangroves, while inland grow sea-grape, wild fig, pawpaw, and buttonwood. They contain shell mounds, and at Key Marco evidence of a culture belonging to the Stone Age have been brought to light. The ancient people which dwelt here attained marvellous skill in making pottery, and in working in copper with shark's teeth and fish bones.

The Inambari.—In vol. xii. p. 100 mention was made of a route between the

Madre de Dios and Ucayali, which was discovered by a Mr. Fitzgerald (spelled Fiscarrald in the report of Dr. Ramon Paz). This gentleman has now navigated the Madre de Dios in a small steamer, which was drawn overland for a distance of fifteen miles between the two rivers. If the route can be permanently opened to traffic, goods will be forwarded to the Madre de Dios without having to pass the dangerous rapids of the Madeira, and at less expense.

Mr. Fitzgerald confirms the statement of Jésus Rocca that the river discovered by Colonel Pando, and visited by Dr. Ramon Paz, is not the real Inambari. Thus the boundary question is opened afresh, and an expedition is to be sent to explore the true Inambari.—*Globus*, Bd. lxxi. No. 2.

The Navigability of the Tributaries of the Amazon.—Captain M. Melitón Carvajal gives the lengths of the navigable waters of the eastern affluents in the *Bol. de la Soc. Geogr. de Lima*, Tom. v. Trim. 4to. He takes as his starting-point Iquitos in lat. 3° 45′ 53″ S. and long. 73° 11′ W., because the Amazon is navigable from the sea up to this town.

The Marañon is navigable at all seasons, for vessels drawing not more than three feet, from its confluence, lat. 4° 30′ S. and long. 73° 27′ 57″ W., and consequently from Iquitos, up to Borja, lat. 4° 28′ 30″, and long. 77° 30′ 40″. This place is distant 453 miles from Iquitos. The current is on the average three miles an hour. From September to May vessels drawing seven feet can ply along this course. The Huallaga, which enters the Marañon on its right bank, is always navigable by vessels drawing three feet, from its mouth in lat. 5° 0′ 40″ and long. 75° 38′ 35″ up to Achinamisa, a distance of 197 miles. The mean velocity of the stream is three miles an hour. Vessels drawing seven feet can ascend from September to May up to Yurimaguas, 123½ miles.

The Ucayali is navigable for small vessels from its confluence with the Marañon along its whole course to where it is formed, in lat. 10° 43′ 30″ S. and long. 73° 44′ 40″ W., by the union of the Urubamba and Tambo. The distance is 772 miles, and the current three miles per hour. Vessels drawing seven feet can always ascend to the mouth of the Pachitea. This tributary is navigable by vessels drawing six feet to where it is formed by the junction of the Pichis and Palcazu, in lat. 9° 54′ 9″ and long. 74° 53′ 54″ W. This point is 191 miles from the mouth. The river runs at the rate of two and a half miles per hour. The Pichis also is said to be navigable for a distance of seventy-nine miles up to the confluence of the Chivis, and the Palcazu up to the mouth of the Mayro, thirty-six and a half miles. The Tambo has been navigated by small vessels for a distance of twenty miles from its confluence with the Urubamba, and investigations effected in canoes and rafts seem to show that shallow steamers with sufficient steam-power to overcome currents of ten miles an hour, and capable of being turned within a small circle, might ply along its whole course; and that they might ascend the Perené to Pangoa, and the Ene to the junction of the Mantaro and Apurimac, both of which are probably navigable for some distance. The Urubamba has been navigated for thirty-five miles by a steamer drawing three feet and capable of steaming eight miles per hour, and it is believed that it could be ascended for 180 miles, up to lat. 11° 10′ S. and long. 73° 1′, where the current is five miles per hour. Its affluent, the Camisea or Paucartambo, which enters at this point, is probably navigable for sixty miles.

There are other rivers which may be suitable for steam navigation, if the reports of explorers may be relied on; but investigations carried on in rafts which hug the shore can throw little light on the rapidity of the current in the deep central channels, or the steerage room, etc. An inspection of the following table shows

that the known waterways navigable by steamers within the limits of Peru have an aggregate length of 2020½ miles.

The Amazons (from the Yavari on the frontier to the junction of the Ucayali and Marañon),	376 miles.
The Marañon,	393 „
The Ucayali,	772 „
The Huallaga,	197 „
The Pachitea,	191 „
The Palcazu,	36½ „
The Tambo,	20 „
The Urubamba,	35 „
	2020½ miles.

The report of Captain Melitón Carvajal is also published in English.

Territory of Santa Cruz.—In the *Bol. del Instituto Geogr. Argentino*, Tom. xvii. Nos. 7-9, Señor C. Siewert describes a journey to this part of Patagonia made in 1894. Puerto Gallegos, the capital of the territory, at which Señor Siewert landed, makes at first sight no striking impression. The south shore is sandy and pebbly; the north exhibits cliffs 400 to 500 feet high, hills, and flat-topped elevations, intersected by numerous valleys and ravines, almost always sheltered from the winds. Pretty houses and cottages, horses, cows, and large flocks of sheep enliven the landscape, in which the green of the pastures is conspicuous, though unprotected by trees. Except the Argentine officials, everything in Puerto Gallegos is English—people, language, animals, food, and drink. Sheep-rearing is the industry of the place. Every one is a sheep-owner, or is interested in the industry. The animals are of Lincoln breed, and become extraordinarily fat. Cattle are kept only to supply the local demand for milk, butter, cheese, and meat. Draught oxen are dear, as also horses. The houses, of wood and zinc, are very comfortable, and furnished with a certain degree of luxury. Stoves are indispensable in the winter. Snow falls in the winter months, from the end of May to August, but it is not heavy, and disappears in two or three days. Indeed, the winter is not as severe as might be expected from the coolness of the summer, when the thermometer rarely rises above 59° F. Winds, which are very disagreeable in summer, do not prevail in winter. In this season the guanacos come down into the valleys in great multitudes, and are so tame and bold that they may be caught by the hand. Beasts of prey are not troublesome; the puma is withdrawing more and more from the neighbourhood, and foxes have never committed depredations in the sheepfolds. Birds are numerous and of all sizes, from the ostrich (*Rhea*) downwards. Snakes are fairly common, but are not poisonous.

To the north of Puerto Gallegos bay, which runs eight or ten leagues into the land, are hills of sand, so compact that they descend in cliffs to the water. In the interior are lagoons of various dimensions, some salt and others fresh, on the banks of which grow shrubs that furnish fuel for the stoves. On this side there are no mountains. Towards the south are numerous heights of volcanic origin. Lava has run in all directions, and covers a considerable extent of land. The most important groups of elevations are known as the Conventos y los Frailes, Los Tres Hermanos, La Sierra Negra, etc. The rock is basalt of a dark grey or russet colour. At present the craters are quite extinct.

Señor Siewert's work led him into the interior, up the valley of the Rio

Gallegos. The river is not navigable; its breadth is about sixty yards, and its depth on the average not much over three feet. It flows with a slow current, describing great curves, and moving from one side to the other of its valley, some two miles broad. Thirty miles from the coast the country becomes more uneven, the ridges increase in height, and the cliffs are steeper. At the Morros, where the Gallegos changes its direction, Señor Siewert stayed several days. The soil is fertile, and the pasturage abundant, and the scenery lovely, advantages which have led to the establishment of several sheep-runs, most of them belonging to Englishmen. The Morros are enormous, isolated hills, composed of columns of basalt like the pipes of an organ. They are known as the Morro Philippi and Morro Domeyco. Near to are also the Morro Gay, the Morro Cuadrado, and, in Chilian territory, the Morro Chico. Except the last, all are bare of trees, and the snow in the fissures on their summits never disappears throughout the year. A large lagoon, more than two leagues long and one broad, lies at the base of the Morro Philippi, about which are seen multitudes of flamingoes, swans, ducks, and geese; it also contains fish. In this region the Gallegos receives several important affluents—the Rubio, Condor, Surdo, and others. Game is abundant in the neighbourhood; in the open are the ostrich and the guanaco, and among the hills the puma, wolf, fox, etc.

Travelling northwards Señor Siewert passed a ridge of fair height, where the riding horses stumbled at every step into the holes of the *cururú*, a small rodent similar to the *tucutuco* of Buenos Aires. The country became still more diversified, rich in forest and with abundant water. On the second day several valleys and ravines were crossed, and rivers and lagoons were passed. The following morning snowy heights were seen to the west and north-west, which the guide called Moor's Monument and Baguales. Towards those the traveller rode across plains, in general ugly, skirting the shores of the lagoon La Travesia, and crossing valleys watered by affluents of the Rio Coy. On the evening of the second day a range fully 1000 feet high was reached, whence the view extended over an immense depression almost entirely enclosed by snow-capped summits. Rivers and brooks ran in all directions, and the peaks of the mountains were reflected in the limpid waters of lagoons. Here and there were scattered woods of tall beech-trees (*Fagus Dombeyi*). Señor Siewert's companions, who were Scotsmen, were strongly reminded of their native land. Besides nuts, the beech-tree bears in old age a quantity of round excrescences as large as a small apple, which are stored by the Indians for winter provisions. Perhaps they are gall-nuts or of similar nature.

Accompanied by Long Jack, a settler in this country, Señor Siewert climbed a chain, where silver, copper, and coal were said to exist. No minerals were found, but the view was magnificent, embracing the majestic Payné mountain to the west, with its immense snowfields and glaciers. At the travellers' feet stretched a lake of pure blue water, from the midst of which rose a huge mass of rock. Woods surrounded the lake and extended up the flanks of the mountains. This lake, which the traveller visited the following day, appears in the map accompanying the article as running in three long arms towards the north-east, named the Lago Payné, Lago del Castillo, and Lago Sarmiento. After returning from this excursion, Señor Siewert travelled southwards, passing between the Sierra Sol and the Sierra del Castillo to Last Hope Inlet, a channel lying between mountains and cliffs, whence glaciers, fringed with forest, descend to the water's edge. The country is admirably suited for grazing, and is not so very far removed from the outer world. Punta Arenas can be reached with good horses in two days, and thence a steamer runs in five days to Monte Video.

GENERAL.

Oxygen and Carbonic Acid in Sea-Water.—Herr Martin Knudsen, who accompanied the late *Ingolf* expedition to Icelandic waters, has published some preliminary remarks on the relation of Plankton to the gases absorbed in sea-water. In his article on "Swedish Hydrographic Research," in vol. x., Dr. Pettersson referred to Tornœ's theory that the quantity of nitrogen in water from lower depths, remaining unchanged, furnishes a datum for determining the temperature at which it was absorbed at the surface of the sea, and that hence it may be ascertained from what part of the ocean any particular layer of water has come. The decrease of the proportion of oxygen to nitrogen with the depth was supposed to be due to the presence of organic matter and living organisms, while on the surface the proportion was supposed to be such as would result from the saturation with air of water of a given salinity and temperature. But both Tornœ and Dittmar were surprised at the not infrequent occurrence of an excess of oxygen above the quantity demanded by the law of gas absorption. Dr. Rördan, also, in examining specimens of water from the Danish seas observed great variations in the relative quantities of oxygen and nitrogen, though the depth from which they were taken in no case exceeded fifty-five fathoms. These he attributed to a defective method of analysis, supposing that a change might have taken place in the water after it was taken from the sea.

During the second voyage of the *Ingolf* in Icelandic waters, Herr Knudsen examined on board 150 specimens of water, some from the surface, with an apparatus of his own design, and the Plankton was at the same time examined by Candidate Ostenfeld-Hansen. It was then found that where the Plankton consisted chiefly of animal organisms the amount of oxygen in the water was very small, while it was large where vegetable Plankton predominated. The result is easily explained, for animal organisms breathe in oxygen, whereas plants, containing chlorophyll or similar colouring matter, assimilate carbonic acid and set free the oxygen when exposed to light. In order to test more rigidly the action of these organisms, HH. Knudsen and Ostenfeld-Hansen filled three bottles with water, in one of which they placed some living copepods. After the bottle had stood for three hours it was found that the copepods had absorbed a little more oxygen than the carbonic acid they had breathed out, as shown in a table printed in the article quoted from. Another experiment was made with diatoms, the same number being placed in each of two bottles, and one of the bottles wrapped in tinfoil to exclude the light. These bottles also were tested after three hours, and the diatoms exposed to the light had developed eleven ccm. of oxygen per litre of water.

No certain relation, then, between the carbonic acid contained in water, the position of its origin, and the time that has elapsed since it left the surface, has yet been established. It is not surprising if large and unexpected variations occur in the percentage of carbonic acid, which is to a large extent dependent on the Plankton, and not only on the Plankton existing at any spot, but also on that which has previously lived in the water and is not yet entirely decomposed. The distribution of Plankton is subject to certain general laws, but great variation in its quantity and kind are observed in closely adjacent places where the conditions of life might be supposed to be identical.

Abnormal Tides.—Among the greatest obstacles to navigation in Greek waters are the tides in the strait of Chalcis between Eubœa and the mainland, the ancient Euripus. In its narrowest point the strait is only 129 feet across, and the water

at certain times runs through it with a velocity of six or seven knots an hour. Formerly it was 100 feet broad, but it has been widened at considerable expense, with a view to slackening the current; but the result has been diametrically opposite to what was expected. Professor Krümmel of Kiel some time ago turned his attention to the movements of the tides in this strait, but he had not at his disposal data sufficient for a thorough examination of the phenomenon.

Admiral Makarof, therefore, being in the Mediterranean in 1894, resolved to carry out a series of observations, and for the purpose borrowed from the Director of the Corinth Canal the machinery of two Collin tide-gauges, which he fitted into temporary wooden frames. This arrangement he found worked very well. Admiral Makarof was unable to complete his observations, being suddenly called away to the East; but he made enough to convince him that the level of the water in the archipelago is subject to many changes of level, which are quite independent of wind and atmospheric pressure. The tidal wave, in flowing among the islands of the archipelago, is divided, and the waters following shorter or longer routes, and being retarded more or less according to the breadth of the passages, arrive at any particular spot at different times, and hence, according to Admiral Makarof, produce the fluctuations referred to.

In 1895 the Admiral examined La Pérouse strait, where the movements are very complicated, and a layer of cold water covers the surface. He collected abundant material, which has not been worked out thoroughly; but, as far as can be judged, the account given in *The Vitiaz in the Pacific Ocean* will need few corrections. The tidal wave reaches the strait by two routes, through the Corea Channel and from the Kurile islands, and thus the tidal movements at Cape Krilon are very complicated. As a rule there is one tide in the twenty-four hours, and the ebb proceeds more or less regularly; but after a few days a second flood begins to appear, which in time overcomes, as it were, the former, and there is again one flood and one ebb in the day.—*Izvestiya* of the Imp. Russ. Geogr. Soc., Tom. xxxii. No. 3.

MISCELLANEOUS.

The population of **Greece**, as shown by a recent census, is 2,418,000, being 230,000 more than in 1889. Athens has 128,000 inhabitants.

The territories of Obock, Tadjourah, and of the Danakil have been united under the title of **Côte des Somalis et ses Dépendances**, with Djibouti as the chief town.

An experimental station has been formed in Zanzibar for the study of the **agricultural resources of East Africa**, and the suitability of various crops for cultivation in that region.

Coal deposits, found at about seven miles from the northern end of **Nyassa**, have proved to be very valuable. The principal seam has a thickness of sixteen feet, and above this lies a second seam eight feet thick.—*Globus*, Bd. lxx. No. 24.

Dr. O. Nordenskiöld, who last year travelled in Tierra del Fuego, will sail this month in the Chilian vessel *Magellanes* for the **South Shetland** Islands. Coal seams and guano deposits are said to exist on them, and gold is also reported to occur there.—*Globus*, Bd. lxxi. No. 1.

According to the *Singapore Free Press* of Nov. 26, a splendid harbour has been discovered on the coast of **Melville Island**, Australia. It is said to be opposite Karslake Island, and to be a magnificent sheet of water, with many striking points of resemblance to Sydney harbour.

It is proposed to establish a meteorological observatory on Monte Rosa, at the hut erected three years ago for tourists on the Pic Giuffetti. This observatory will rank fourth as regards elevation, after those of Arequipa, Mont Blanc, and Pike's Peak.—*Revue Scientifique*, Dec. 26.

A few fragments of the skull of a monkey—not a lemur—have been discovered in Madagascar. Mr. Forsyth Major describes them in the *Geological Magazine*, and gives to this anthropoid monkey the name of *Nesopithecus*. He considers that it belongs to a group intermediate in some respects between the *Cercopithecidæ* of the Old World and the *Cebidæ* of South America.

That immigration into the United States has considerably declined is further confirmed by the report of the Commissioner for 1895-96. During the year 343,267 persons arrived in the States, of whom 2799 were not allowed to land. The money which they brought with them amounted to 4,917,318 dollars. Compared with the average for the last ten years, the number is 91,818 less, or more than twenty-one per cent. 212,466 were males and 130,801 females.—*Globus*, Bd. lxxi. No. 1.

M. Madrolle visited Hainan in March and April last year. The island is very picturesque, especially in the south. The Sai tribe inhabits the forest-clad mountains. The Chinese speak four different dialects, which have no resemblance to those spoken by Chinese on the mainland. The people are laborious, and the land is suited for agriculture and grazing. The traveller observed deposits of copper, argentiferous lead, gold, and tin.—*Comptes Rendus* of the Paris Geographical Society, Nos. 15 and 16, 1896.

The *Annals of Scottish Natural History* for the present quarter contain, among other articles, a "List of the Birds of Berwick-on-Tweed," by Mr. George Bolam, some notes on "New and Rare British Diptera," by Mr. P. H. Grimshaw, and a paper "On the Flora of Eigg," by Mr. S. M. Macvicar. A large number of notes on various zoological and botanical subjects, a list of papers and notes relating to events in Scottish natural history, which have occurred during the past quarter, and book reviews, fill up the number.

In South Russia, in the Government of Tauris, ostrich breeding has been introduced, and with complete success. The birds seem to bear cold well, and wander contentedly over the steppe. The first crop of feathers has been sent to Paris and has there sold well. The attempt of the French to introduce the industry into Algeria has not been very successful. The climate of the plateau of Oran suits the birds, though it is damper and colder than that of their native haunts in South Africa, but the feathers lose their colour.—*Deutsche Rundschau*, Jahrg. xix. No. 4.

At a meeting of the Geographical Society in December, Mr. W. J. Lewis Abbott exhibited flints bearing a striking resemblance to the work of man, which had been found in the Cromer Forest Bed. According to Prestwich, the Forest Bed lies at the base of the Pleistocene system, but now it is generally regarded as forming the top of the Pliocene. It contains the remains of the cave-bear, rhinoceros, various species of elephant, deer, etc. The remains of man have never been found at so low a horizon, in Great Britain at any rate.—*Natural Science*, Jan.

Some twenty miles south of the mouth of the Cunene a harbour has been discovered by the Esser expedition. Hills about a hundred feet high send out a spur into the sea, which protects from the surf a small bay with a shore of one and a

half to two miles in length. It has been named Augusta Victoria Hafen. The mouth of the Cunene is useless as a landing place, being sanded up and having a depth of twenty inches at most. Three miles up the bed is rocky, and there are five feet of water even in the dry season. A port at Augusta Victoria Hafen, should landing prove practicable here, might perhaps serve as an emporium for the Portuguese possessions on the river.—*Deutsche Kolonialzeitung*, January.

In October a **kite** sent up from the Blue Hill observatory reached a height of 9375 feet above sea-level, the highest flight hitherto recorded. The temperature fell from 46° F. on the hill to 20° at the highest point. The future of this means of recording meteorologic data is very promising. The expense is very trifling compared to that incurred by balloons, and if the kites can be sent up above the varying currents on the Earth's surface, there seems no reason why they should not be kept up twenty-four hours at a time. Indeed it is possible that continuous records may hereafter be obtained by kite meteorographs.—*Science*, Nov. 13.

Much information concerning kites, as used in meteorological work, is contained in the *Monthly Weather Review* of last year.

The International Exhibition to be held this year in Brussels will contain a **Scientific Section**, divided into seven classes, viz., Mathematics and Astronomy, Physics, Chemistry, Geology and Geography, Biology, Anthropology, and Bibliography. In the class for Geology and Geography it is proposed to exhibit photographs, models, specimens, etc., showing geological structure, the effects of erosion, earthquakes, volcanic eruptions, and other phenomena, diagrams, etc., illustrating hydrographical questions, sounding apparatus, etc., etc. Palæontology will also be included.

Prizes to the aggregate value of 20,000 francs (£800) will be offered for the best solutions of certain scientific problems to be propounded by the section.

Full information may be obtained from the Commissariat général du Gouvernement, 17 Rue de la Presse, Brussels.

The annual report of the **Geographical Association** shows a steady increase in numbers, the Association being now represented in forty-four secondary schools, including most of the great public schools. In the course of the year 1896 two lectures were published by the Association, one by Mr. B. B. Dickinson, explaining his method of teaching geography by means of lantern-slide maps and diagrams, and the other by Mr. E. R. Wethey, entitled "A Geography Lesson; the Blackboard and Oral teaching." A revised catalogue of the Association's slides, then amounting to 684, was issued in March. The number has since been considerably increased, and Mr. Dickinson is now engaged in remaking many of the early experimental slides, with improvements suggested by increased experience and newer methods. Demonstrations of the use of the optical lantern in teaching were given at the General Conference of the Teachers' Guild in January 1896, and at the Headmasters' Conference in December, as well as on other occasions.

The chief work of the past year has, however, been to prepare and send out a memorial (see vol. xii. p. 326) to certain boards of public examiners on the subject of reforms in examinations in geography.

The results thus far obtained are recorded in a separate report, and are in some cases most encouraging.

The Oxford delegates and Cambridge syndics for local examinations expressed their general agreement with the principles advocated by the Association and their willingness to consider any more detailed suggestions that the Association might wish to make. With the view of encouraging the higher study of geography, and

of providing an examination which may serve as a satisfactory test of a teacher's knowledge of the subject, they have decided to include geography as a new group in the higher local examinations. Full particulars will be found in the new regulations for 1896-7.

The Oxford and Cambridge Schools Examination Board, after considering the memorial, decided to insert the following paragraph in the regulations affecting geography in the lower certificate examination :—

"The questions shall be set on the assumption that the main principles of physical geography form the basis of geographical teaching."

The Council of the Victoria University, Manchester, received the memorial with much favour, and a special committee of the Board of Studies has been appointed to consider the question of giving geography a more important place in the preliminary examinations.

The improved style of questions on geography set in the Army Entrance Examinations during the last few years encourages the belief that the Civil Service Commissioners are to a large extent in sympathy with the aims of the Association. But the marks assigned to the paper on geography (500) are certainly inadequate in view of the amount and wide range of the knowledge that is required.

The annual meeting was held in the hall of Dr. Williams' library, Gordon Square, on Wednesday, December 23rd, 1896, Mr. J. G. Colmer, C.M.G., in the Chair. After the transaction of business, a paper was read by Mr. A. W. Andrews on "The Teaching of Geography in Preparatory Schools and Junior Classes," which was followed by a discussion. Mr. Andrews also reported that at the Conference of Headmasters of Preparatory Schools, held in London on December 22nd, the following resolution had been carried :—"That it is desirable that every boy, before admission to a public school, should have to pass an elementary examination in History and Geography." The Committee of the Geographical Association have decided to give their hearty support to this resolution, and to address a letter on the subject to the headmasters of public schools.

NEW BOOKS.

Joseph Thomson, African Explorer. A Biography by his Brother (Rev. J. B. Thomson, Greenock), with Contributions by Friends. Six Maps and Illustrations. London : Sampson Low, Marston, and Company, Limited, 1896. Pp. 358. *Price 7s. 6d.*

The life of Joseph Thomson goes far to prove that the qualities requisite for a great explorer must be born in a man. He must have the yearning after the unknown, the longing to solve great problems. He must have an imagination strong enough to keep a clear ideal constantly and vividly before his mind's eye. He must have a persistent enthusiasm and a courage strong enough for much endurance. He must have an insight into human nature, ready resource, and the power to command. These are the qualities to carry a man through the difficulties and dangers of an unexplored savage country ; but if he is to carry anything away with him he must have other inborn powers. He must have the geographical instinct ; his eye must be trained to receive accurate impressions, to grasp the structure of a country, to observe the manners and customs of its inhabitants, to note new forms of animal and plant life, and, finally, to have the gift of recording

all that he has seen. This may seem a large demand from one man, but Thomson had all these qualities, and all our great explorers have possessed them.

In writing a faithful biography, nothing is more requisite than a sympathetic touch, and to this the undoubted success of the present volume is largely due. Mr. Thomson is to be congratulated on his work; it is bright and well sustained from beginning to end. In a clear and realistic style the story is told of the lad born and bred among the picturesque natural beauties and romantic associations of Nithsdale —scenes that seem to have left a permanent imprint on the character of the young explorer. One is carried from point to point of his adventurous career, his early aspirations, his cravings for knowledge, his pluck and perseverance, until we see him fairly launched on his own resources in Central Africa and his efforts crowned with success. Thomson's achievements are known to most of us, but the romance of his life may not be so fully realised. At first sight it may seem to us that Fate dealt hardly in cutting short his career at an age when many men are only beginning to task their deeper energies. But he had already accomplished a life's work. His opportunity, by an event little foreseen, came exceptionally early, and he proved himself ready for it. Thirteen years devoted to Africa with such brilliant results would be a good record even for a long life.

As a story of courage, enthusiasm, and endurance, Thomson's life ought to be a stimulus to future generations of Scotsmen. Geography owes him much, but, to quote his own words, "After all, it is not so such what one does of himself which specially distinguishes the great man. It is rather that stimulating and living force which goes out of him and becomes imparted to others—firing them to follow in his path, and stimulating them to better deeds and nobler lives."

Aus China: Reiseerlebnisse, Natur- und Völkerbilder. Von W. Obrutschew. 2 vols. Leipzig: Duncker and Humblot, 1896. Pp. 262 and 235. *Price* 8 *Marks.*

The author of the *Sibirische Briefe* (*rev.* vol. x. p. 270), Herr Obrutschew, gives these volumes valuable details regarding China which he obtained when attached, in 1892, as geologist to Herr Potanin's expedition, the object of which was to study the botany, zoology, geography, and ethnology of the western part of the Chinese province Sze-tschuan, and the neighbouring eastern parts of Tibet, as far as Li-tang and Ba-tang. He was also connected with Captain Roborowsky's expedition; but during his two years' residence in China he was at liberty to go where he chose, and he accordingly devoted himself to geological researches in Central Asia, in the northern provinces of China, in Nan-schan, and eastern Tiën-schan. He passed from Siberia through Mongolia to Pekin, and then proceeded to Su-tschou and other parts of China, returning *via* Siberia to his home in St. Petersburg. Perhaps his remarks on the idiosyncracies of the Chinese are as salient as any. He says:—

"The leading characteristic of the Chinese people is self-satisfaction. 'China knows everything, China can do everything, China possesses everything.' Thoroughly convinced of the perfection of his fatherland, the Chinaman will not believe that anything better can be obtained anywhere else in the world. Even Chinamen who have resided for a long time in Europe, and have become acquainted with its higher civilisation, although they admit that much is better there than in China, add that it is only better for the 'foreign devils,' as they designate all foreigners without exception. So they return to their cardboard-houses and manure-heaps, their steaming 'kangs' and paper windows, their oil-lamps and dung-fires, to their everlasting rice, their want of washing and water, and to the pigtails and other attributes of Chinamen at home." The author afterwards continues:— "Against the fatal self-satisfaction and want of energy of the Chinese, we must

set their staying powers and their small requirements. In spite of the insecure and by no means enviable conditions of life of the greater part of the population, in spite of the incessant struggle for existence among them, the Chinese never lose patience, and stoically submit to every trial without a thought of the future. If a humble existence at home becomes impossible, the Chinaman does not 'strike' like a European working-man, nor does he commit any disorder; he simply removes to another province, or at worst abroad, where he becomes a very dangerous rival of local workmen, for, whilst the intensity of his physical exertion is much weaker than that of the white man, his modesty and contentedness cause him to be everywhere welcomed by employers. He will work for any wages, and comply with almost impossible conditions; yet, peculiar and conservative as he is, he will never assimilate with the nation which employs him. Wherever he goes he erects his singular quarters, builds his stable-like Fansas, establishes his cook-shop and opium den, gathers his filth up in a heap, and retains the costume and manners of China. However fortunate he may be abroad, he always returns home, which is the more intelligible when we remember that a Chinaman can never take his wife or other Chinese woman abroad with him, social customs forbidding their departure from China."

Through the Subarctic Forest. By W. Warburton Pike, author of *The Barren Grounds of Canada.* London and New York: Edward Arnold, 1896. Pp. xiv + 295. *Price* 16*s.*

Mr. Warburton Pike's latest book takes us to the wilds of North-Western Canada. In 1892 he travelled from Fort Wrangel up the Stikine river to the Pelly lakes, and thence down the Yukon river and, partly along the shore of the Bering Sea, to Nushagak, where a steamer picked him up. *Through the Subarctic Forest* is a detailed description of this daring and sometimes dangerous journey. Part of the country visited by him being absolutely new ground, Mr. Pike has been able to add to our geographical knowledge, and some corrections to the maps with regard to the Pelly river, prepared from Indian reports, are embodied in the map published along with the volume. For food Mr. Pike depended largely on the moose, and the following information will be welcome news to the sportsman: "It gives me the greatest pleasure to be able to report that, at this late date, when from almost every part of the world the cry arises that the wild animals are being exterminated, there is still a remote corner where the noblest animal of the whole deer family is increasing and multiplying at an almost incredible rate." But there does not seem to be much chance for the gold miner—at least Mr. Pike did not come across the precious metal in paying quantity. Of the natives we hear only the same old story, how civilisation, as represented by the miner and the trader, will soon destroy them body and soul unless something is done by the Government. Here, surely, is a rich field for missionary labour. The book is a splendid testimony to Mr. Pike's pluck, and it will prove a valuable guide to those who intend to visit those regions. Mr. C. Whymper has contributed some beautiful illustrations.

Among Pagodas and Fair Ladies: An Account of a Tour through Burma. By Gwendolen Trench Gascoigne, Author of "A Step Aside." With numerous Illustrations. London: A. D. Innes and Co., 1896. Pp. 312. *Price* 12*s.*

The authoress went to Burma on a visit, fell in love with the country and people at first sight, and has been led to publish her impressions "in the hope that her work may awaken in some and increase in others an interest in a country which possesses an infinite charm and attractiveness—an attractiveness not yet quite ruined by contamination with our European civilisation—and in its most fascinating

inhabitants." The book is recommended in a prefatory note by the Financial Commissioner of Burma, who says that the authoress has caught the quaint picturesque ways of the people, and portrayed them with fidelity. Such a recommendation from one who knows both country and people thoroughly seems to render much further remark unnecessary. The authoress is certainly a kindly and indulgent critic of the people. The men, it is true, are weak and indolent, but these little defects form a small drawback to their "charming personality" and many "delightful qualities." The women, on the other hand, seem to fall little short of perfection; after lavishing epithets of praise, Mrs. Gascoigne wonders if she has succeeded in her efforts to do full justice to their graces and charms, and she rarely recurs to this subject without indulging in some expression of admiration. Undoubtedly, the temper that leads to such judgments is that which makes travel a source of real pleasure, and fits a traveller to do justice to those among whom he sojourns, and it is infinitely preferable to the opposite extreme which takes offence at everything unfamiliar, and depreciates whatever is different from the standard of his own country. But it is possible to have too much even of a good thing, and one comes rather to wish that the invariable *couleur de rose* were mixed occasionally with a little sober and more prosaic grey. And though, as the recommendatory note says, the sketches are bright, and on the whole are pleasant to read, yet one cannot but see that there is a little too much straining after smartness; that in her attempts at fine writing the authoress rather gets out of her depth, not appreciating the exact force of words, and that the rules of grammar and composition are not always so carefully observed as they should be in what is prepared for publication.

Across Siberia on the Great Post Road. By Charles Wenyon, M.D. London: Charles H. Kelly, 1896. Pp. 240. *Price* 3*s.* 6*d.*

An important section of the Trans-Siberian Railway having been opened for traffic within the past two years, Dr. Wenyon thinks "he was perhaps one of the last Englishmen to travel the whole distance from the Pacific coast to the Ural Mountains in the old-fashioned way" along the great post road of Siberia, in the spring and summer of 1893. In this volume he details his experiences, which, however, relate not merely to travelling along a "post road," but in steamers from Khanka to the Amoor, up the Amoor from Khabarofka to Stretensk, and across Lake Baikal. On the actual post road itself he travelled in a "tarantass," a Russian four-wheeled carriage, "which is neither a trap, nor a buggy, nor a cart, nor a waggon, but a sort of conveyance which combines the inconveniences of all." It is usually drawn by a team of three horses, and so violently are passengers jolted by the wild gallop along the rougher portions of the road, that "every Russian traveller in Siberia carries one or two large pillows with him,"—for "after going up a certain distance one's head strikes against the woodwork (of the tarantass) which sends us down again more quickly even than we went up, and happy are we then if we have some good soft pillows to fall down upon." Owing to the agreeable Russian officers he met, Dr. Wenyon had often pleasanter experiences during his journey, which he relates with considerable literary skill. As a reliable account of Siberia as it was in 1893, this little book may be highly commended.

Three Gringos in Venezuela and Central America. By Richard Harding Davis. New York: Harper and Brothers, 1896. Pp. 282. With many Illustrations and three Maps.

Of the three "gringos" (foreigners) in question, two were American and one British; and their journeyings and experiences are very pleasantly chronicled by

Mr. Harding Davis' light and facile pen. Their route was from New Orleans to Belize, thence southward across the mountains of Honduras to San Lorenzo on the Pacific Coast, thereafter by sailing-boat and steamer to Panama, and so across the Isthmus to Colon, whence they sailed to La Guayra, the port of Caracas. From beginning to end the book is excellent reading, and one not only obtains from it a great deal of information with regard to the scenery of the Central American countries and their existing social conditions, but that information is conveyed in a crisp and forcible manner, and enlightened with many bright gleams of humour. That the author, although a loyal citizen of the United States, has little faith in the stability or worth of the sister republics lying farther south, is apparent from such remarks as the following (pp. 146-148) :—

"The Central-American citizen is no more fit for a republican form of government than he is for an Arctic expedition, and what he needs is to have a protectorate established over him, either by the United States or by another power; it does not matter which, so long as it leaves the Nicaragua Canal in our hands. In the capital of Costa Rica there is a statue of the Republic, in the form of a young woman standing with her foot on the neck of General Walker, the American filibuster. We had planned to go to the capital for the express purpose of tearing that statue down some night, or blowing it up; so it is perhaps just as well for us that we could not get there; but it would have been a very good thing for Costa Rica if Walker, or any other man of force, had put his foot on the neck of every republic in Central America, and turned it to some account. . . . The Central-Americans are like a gang of semi-barbarians in a beautifully furnished house, of which they can understand neither its possibilities of comfort nor its use. They are the dogs in the manger among nations. Nature has given to their country great pasture-lands, wonderful forests of rare woods and fruits, treasures of silver and gold and iron, and soil rich enough to supply the world with coffee, and it only waits for an honest effort to make it the natural highway of traffic from every portion of the globe. . . . Nature has done so much [in making a passage-way across Nicaragua and again at the Isthmus] that there is little left for man to do, but it will have to be some other man than a native-born Central-American who is to do it."

Mr Davis is a great believer in the pressing importance of completing the Nicaraguan Canal; and a glance at his "Map of the World showing Change in Trade Routes" which would result from that achievement, is enough to rouse the most apathetic into sympathy with his views.

The book is prettily illustrated throughout, mostly by reproductions of photographs taken by the "gringos" themselves. The only other detail that seems to call for remark is the use of "Honduranian" and "Guatemallecan" instead of the recognised and much more preferable "Honduran" and "Guatemalan."

The Western Avernus; or, Toil and Travel in Further North America. By Morley Roberts. New Edition, illustrated. Westminster: A. Constable and Co., 1896. Pp. xii + 277. *Price 7s. 6d.* net.

This is more an autobiography than a book of travel. It is an account of the author's adventures, first as a cowboy in Texas, and then as a labourer on the Canadian Pacific Railway, his tramp across the Selkirks and Coast Range, and eventual arrival in San Francisco, where he spends his last dollar and is "dead broke." The story is most interesting from beginning to end. The book is beautifully illustrated from photographs of some of the finest scenery in the far North-west. After perusal, the reader is apt to wonder why a man of education and means should voluntarily expose himself to such hardships.

Six Months in Jerusalem: Impressions of the Work of England in and for the Holy City. By the Rev. Charles Biggs, M.A., Fereday Fellow of St. John's College, Oxford; sometime Chaplain to Bishop Blyth. London and Oxford: Mowbray and Co. Pp. xiii+365.

Mr. Biggs seems to have had three objects in view when he published the impressions he formed from a residence of six months in Jerusalem. The first is to point out and establish the importance of the English Church being represented at Jerusalem by a bishop, and not by a mere presbyter, if England is to do for reconciliation of and with oriental churches the work which her "reverent mediocrity," so likely to attract the spiritual sympathies of divided and mutually hostile sects, fits her to undertake. This, which is the burden of a considerable part of the book, is addressed specially to English Churchmen, and is obviously a subject of which any discussion in the pages of this *Magazine*, or criticism of the views and arguments advanced, would be out of place. The next object seems to have been to maintain the trustworthiness generally of the local traditions as to the scenes of events in sacred history and relics associated with persons held in reverence by Christians, about which "little controversy could arise were it not for theological animosities" and "unreasonable prejudice." Thus he holds that the true cross, on which Jesus was crucified, was discovered by Helena; that the actual tomb of Jesus was discovered, "under the rubbish piled on it by Hadrian, by a search as scientific as any made by the Palestine Exploration Society"; and so on, down to the fissure made in the rock by the earthquake at the crucifixion, into which, "for proof," he thrust his hand, and to the hole where grew the tree from which the cross was made, which tree, moreover, was planted by Lot. Only once does he admit having been troubled by questionings, and that was at Nazareth, of which he says, "All the time we were in the chapels of Joseph and the Angel we were haunted by uncomfortable memories of the house at Loretto." It must be admitted that Mr. Biggs has the courage of his convictions, and be set down to his credit that he does not hesitate to describe Solomon's Temple as "the abode of God." The third object is to give information about the ritual and ceremonies of the various oriental churches of which representatives are found at Jerusalem. In regard to these he says, "My happiest memory is of the washing of the feet," when the Patriarch of the Greek Church washed the right foot of twelve bishops before an immense crowd, and the water used for the washing was afterwards sprinkled on the people, who struggled to get near in order to dip into the vessel handkerchiefs carrying concealed bits of sponge, that some of the liquid might be carried away. We must believe Mr. Biggs when he says this was his happiest memory; but tastes differ, and we should never have guessed it. The book is illustrated by some interesting views reproduced from photographs.

Through the Dolomites from Venice to Toblach. By Alex. Robertson, D.D. London: George Allen, 1896. Pp. 232. *Price 7s. 6d.*

The author, the well-known minister of the Scottish Church at Venice, designates the country of the Dolomites "the Scotland of Italy," because of its character and that of its people, and the legendary and historic romance that surrounds them. From the town of Pieve di Cadore came Titian, the great Venetian painter; here he painted and left the picture which Mr. Ruskin considers "the only one he painted religiously," and hither he returned for his *villeggiatura* when the heat of summer made Venice unendurable. Dr. Robertson's book, which is most attractively written and illustrated, will be a powerful means of attracting tourists to the Dolomites, those magnificent magnesian-limestone peaks whose rocks have be-

come so disintegrated and denuded that, as the author remarks, "the wonder is not that they are constantly falling, but that they hold up so well." Dr. Robertson's route through the Dolomites is from Venice to Toblach. We venture to think most British tourists would travel in an opposite direction, the most direct way of reaching the Dolomites being from London to Zurich, then along the splendidly picturesque Arlberg Railway to Innsbruck, thence by rail over the Brenner to Franzenfeste Junction, thence by rail to Toblach, and finally, by coach and rail to Venice—all which can be done for a very small expenditure of time and money, and which furnishes a tour of the most interesting, instructive, and health-giving kind.

Naturvölker und Kulturvölker. Ein Beitrag zur Social-Psychologie. Von ALFRED VIERKANDT. Leipzig: Verlag von Duncker u. Humblot, 1896. Pp. 497. *Price* 10·80 *M.*

The subject of social psychology is new, and a comparison of the social psychology of primitive and civilised peoples forms a fascinating study. This volume craves the indulgence of the critic on the ground that it is only, as it were, an outline of a vast subject which, if it meets with favour, is to be followed by a more extensive work which Alfred Vierkandt has in view. The book is intended for a large circle of readers, the author only stipulating that they shall possess two qualities—first, the ability to think clearly and to arrange a multitude of phenomena under general types; and, secondly, the ability to view human things, *sine ira et studio*, as Nature pictures.

We do not think the author need fear the critics, for he has produced a capital piece of work—one which will stimulate further research, arouse interest, and be at the same time highly instructive. The object of the author in this volume is to deal with general ideas, beliefs, and types, isolated facts being only employed as illustrations. He endeavours to make a psychological study of an enormous mass of folklore facts in the first place, and, secondly, to compare them with the existing condition of modern European culture.

For our readers, it will probably be best to give a list of the contents of the book, rather than a critical examination of the conclusions to which the author comes. Such an examination would be more in place elsewhere.

After an introduction, the first chapter deals with the development of the idea of social psychology; the second with the general conditions of the intellectual life of a community. The third has to do with the difference between primitive and civilised peoples; the fourth is on primitive people, dealing with mythological methods of thought, will, individual and social moral life, and suicide; the fifth surveys the conditions of advanced civilisation; the sixth deals with the qualities of a highly civilised condition; and the last with the rottenness of advanced civilisation.

We cordially congratulate the author upon his work, and sincerely trust that the reception we fully expect it will receive will stimulate him to the further work he contemplates.

The Balkans. Roumania, Bulgaria, Servia and Montenegro. By WILLIAM MILLER, M.A. (Oxon), of the Inner Temple, Barrister-at-law. London: T. Fisher Unwin; New York: G. P. Putnam's Sons, 1896. Pp. xix + 476. *Price* 5*s.*

This volume—the latest addition to the series of the "Story of the Nations"—presents, for the first time in English, a concise, connected and continuous history

of the four leading Balkan States. The pages of Gibbon contain vivid pictures of the early history of the Serbs and Bulgarians, but what is there kept in view is not so much the internal development and special history of those nations, as the bearing of their growth on the fate of the Byzantine Empire, and, of course, their fortunes are not traced beyond the fall of Constantinople. Mr. Miller has had it for his aim to tell the story of each State separately, from the earliest time for which we have information down to the present day, and he has accomplished this object with a success that is indisputable. The story, though full of romantic incident and of marvellous alternations in fortune, is not one that can easily be told so as to be both luminous and interesting. But this is what Mr. Miller has attained. Whether he is dealing with the obscure period of early settlement, or the long struggle with the Byzantine Empire, or the subjection (except in the case of Montenegro) before the advancing power of the Turks, or the long period of slavery and degradation under Turkish rule, or the part played in this by the Fanariote Greeks in the eighteenth century, or the revival of national feeling and the recovery of independence, he is equally interesting and instructive. Skilfully selecting only salient facts and important personages for fuller treatment, he traces the course of events briefly, but in a way which makes the formation of the States and their resultant condition intelligible to every reader; shows how the problems have emerged, the eventual solution of which it baffles the shrewdest politicians to foresee; and throws a flood of light on the elements in the problem which have to be taken into account by all who discuss it, and advocate solutions. The work supplies a distinct need, and does so in a way which merits high praise.

The Story of the Sea. Edited by Q., assisted by Professor J. K. Laughton, Commander C. N. Wilson, Herbert Russell, etc. etc. London, etc.: Cassell and Co., 1896. Pp. viii + 760.

The first volume of this work was reviewed in vol. xii. p. 50, and the remarks there apply in great measure to the present volume. In this, also, a vast quantity of information has been drawn from many different sources, and referring to ancient and more recent times. It is scarcely surprising that in such a large collection of details of the most varied character, some mistakes should occur, and the authors may be congratulated on the smallness of their number. Some of the statements may still find defenders among geographers, as that the Canaries and Madeira were perfectly well known to the Phœnicians, and the story of the elopement of Machin with Anne d'Arfet may still find credence, though it has been pretty conclusively proved by recent investigation to be a myth. It is certain, however, that the mariner's compass was known long before the close of the fourteenth century, and the discovery of Graham's Land by Dirk Gherrits (more correctly Gerritsz), is more than doubtful. Nor, again, can it be said, after the late investigations of the U.S. Coast and Geodetic Survey, that the Gulf Stream is "driven out through the Straits of Florida as through the nozzle of a squirt." A more serious oversight, and one we are at a loss to account for, is the omission of all mention of Lieutenant Lockwood, whose "Furthest North" has only been surpassed by Nansen. This mistake has unfortunately been repeated on the chart, where "Nares" is marked above "Lockwood."

Young people will delight in this book and its interesting and instructive pictures, though it might have been rendered more useful, as we remarked before, by a methodical arrangement of the subjects. No doubt the sudden changes from one subject to another are to avoid wearying the young reader.

Europeesche Kolonisatie in Suriname. Ein geschiedkundige Schets door H. Pijttersen, Tz., Lid van de Tweede Kamer der Staaten-Generaal. 's Gravenhage: W. P. van Stockum en Zoon, 1896. Pp. 147. *Price F.* 1.25.

The history of colonisation in Dutch Guiana, as set forth in these pages, is an illustration of the futility of colonisation organised and fostered by the State. The attempts began in 1747, when some Jewish families were sent out from Europe; in the following year, a number of Swiss were imported into Dutch Guiana; and in 1853, A. Kappler, a German, settled Würtemberg families in the colony of Albina on the river Marowijne, or Maroni. All these colonies gave endless trouble to the Government and were abandoned in a few years. A more determined effort was made in 1844 by the Dutch Government to form a colony of Boers at Groningen on the Saramacca, an undertaking which cost a large sum of money, and was as unsuccessful as the former. It is difficult to decide what were the precise causes of failure—whether the ground chosen was wanting in fertility, and the colony too far from a market, or whether the colonists became impoverished through their own lack of energy. Perhaps the latter cause was sufficient to account for the result, as Heer Pijttersen thinks; and this seems to have been due to their dependence on the Government for help in all their difficulties. They were promised houses ready for occupation on their arrival, and gifts of cattle and provisions until they could provide for themselves; and though all the promises were not exactly fulfilled, they did actually receive much assistance. Many of them therefore emigrated with the expectation of finding a land of Cockayne, and were not disposed to relieve the Government of the burden of supporting them.

Heer Pijttersen then shows us the other side of the picture. After the Government had given up colonisation in despair, a few colonists, some of them from the abandoned Groningen, settled on the Kwatta canal, near Paramaribo, in 1852. At first they received some slight assistance from the Governors van Raders and van Schmidt auf Altenstadt, in loans and cattle, most of which were repaid by 1855, and after that they were left entirely to their own resources. In that year the colony contained seventy-three souls, while in 1895 its population had increased to two hundred, and these earn a comfortable living by their own exertions. In 1884 twenty-five of them declared themselves willing to buy or take on lease 7845 acres of land, if the Government would undertake to drain it and make a road; they are still waiting for an answer.

The Royal Natural History. Edited by Richard Lydekker, B.A, F.R.S., with Preface by P. L. Sclater, M.A., Ph.D., F.R.S. Illustrated with 72 Coloured Plates and 1600 Engravings, by W. Kuhnert, F. Specht, P. J. Smit, G. Mützel, A. T. Elwes, J. Wolf, Gambier Bolton, and many others. Vol. iv. Birds (1895), pp. xv+583; Vol. v. Reptiles, Amphibians, Fishes, etc., pp. xv+584; Vol. vi. Invertebrates, pp. xvi+580. London and New York: Frederick Warne and Co. *Price 9s. per vol. net.*

To what we have already said of this sumptuous and captivating work we have little to add. We would congratulate all concerned on its speedy completion—the erudite editor and his collaborateurs, the publishers, who have been wisely generous, the draughtsmen, whose achievements charm us, and the printers too—all deserve praise. We have already in our library the six volumes of Cassell's *Natural History*—our first love,—the six volumes of the Standard or Riverside *Natural History*, and the ten volumes of Brehm's *Thierleben*, but we feel bound to add this also. We sincerely hope that all naturalists will do the same, and we

feel sure that they will do so if they go to the Society's library and indulge themselves for even half an hour over these volumes. Our major criticism remains that Invertebrates cannot be done justice to in one volume, but, granting this, the whole work is irresistible. We wish it the success it deserves; we wish it a second edition with fewer monkeys and more Invertebrates, and a chapter or two on generalities, which, after all, leaven the whole.

The Romance of Commerce. By J. Macdonald Oxley, LL.B., B.A., author of *Archie Mackenzie*, etc. London and Edinburgh: W. and R. Chambers, 1896. Pp. 242. *Price* 2*s.* 6*d.*

In this volume are collected a few chapters of the romance of commerce, most of them relating to the opening-up of the New World. Among the headings of the chapters are "The Hudson Bay Trading Company," "The Rise and Fall of John Company," "The Quest for a North-West Passage," "The South Sea Bubble," and "The Mediterranean of Canada," the last chapter giving an account of the recent explorations for the purpose of opening a route through Hudson Bay to the north-west territories of Canada. Little space can be devoted to each subject, but those readers who wish to know only the most important facts will find them here.

A Sketch of the Natural History of Australia, with some Notes on Sport. By Frederick G. Aflalo, F.R.G.S., F.Z.S., author of *Sea-Fishing on the English Coast, Hints and Wrinkles on Sea-Fishing.* Illustrated by F. Seth. 8vo. London and New York: Macmillan and Co., 1896. Pp. xxv+307. 31 Illustrations.

This is an unpretentious little book, well adapted for its purpose of serving as a popular guide to the Australian fauna. It is clearly and brightly written, and pleasantly illustrated. The greater part of the book is devoted to the Vertebrates, but the Invertebrates are by no means overlooked. Our only criticism is that the author might have found some friendly zoologist to revise his pages, for this would have obviated certain inaccuracies.

A Geographical History of Mammals. By R. Lydekker, B.A., F.R.S., V.P.G.S., etc. ("Cambridge Geographical Series.") 8vo. Cambridge: University Press, 1896. Pp. xii+400. 82 Figs. 1 Map. *Price* 10*s.* 6*d.*

This volume, like all that comes from Mr. Lydekker's hands, is an admirable piece of work. It is scholarly and thorough, and impresses one with the author's firm grasp of the subject. As the title indicates, the book is confined to mammals, but these are considered in relation to the past as well as the present. The palæontological facts are combined with those of present-day distribution with very valuable results. After a brief introductory chapter, which might perhaps have been extended to advantage, the author describes the notogæic, neogæic, and arctogæic realms, and then passes to the Malagasy, Ethiopian, Oriental, Holarctic, and Sonoran regions. Having ourselves profited much by the perusal of its pages, we can very cordially recommend it to all serious students.

A Physical, Political, and Descriptive Geography. By Keith Johnston, F.R.G.S. Fifth Edition, revised by A. H. Keane, F.R.G.S. London: Edward Stanford, 1896. Pp. xi+490. *Price* 12*s.*

The new edition does not differ essentially from the preceding ones, the work of the editor having been confined to adding a few newer data and statistics. It is hardly necessary to recommend so well-known and tried a text-book.

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band II. Jahrgang 1893. Berlin: H. W. Kühl, 1896.

For the second year the Geographical Society has issued its *Bibliography* in separate form. The first volume, reviewed in vol. xi. p. 327, contained the books issued in 1891 and 1892, the number of entries being about 13,800, whereas the number is rather over 10,000 for the single year 1893. Everything is apparently entered, the most insignificant articles as well as the most important narratives of new explorations. The works are entered under various headings, such as Physical Geography, Biological Geography, etc., and also under continents and countries. One cannot but admire the patience of Dr. Baschin and his collaborators and the thoroughness of their work. Our only doubt is that it may be rather too thorough; a rejection of mere compilations from well-known authorities and narratives of globe-trotting might render the book more easy of reference for the student.

Welsh Mountaineering. A Practical Guide to the Ascent of the Principal Mountains in Wales. By Alex. W. Perry. London: L. Upcott Gill, 1896. Pp. 172.

Mr. Perry has written a brief description of the best paths to the chief Welsh heights from various centres, which will be useful to the pedestrian who does not know the country well. A number of small sketch-maps illustrate his directions, which are purely practical and not rhapsodical.

Mr. Perry would like to see a Welsh mountaineering club formed of those interested in climbing Welsh mountains, and capable of covering a selected route up hill and down dale within a certain time. The scheme is certainly to be commended, and we hope Mr. Perry will succeed in doing for the Welsh mountains what the popular *Vereine* of different countries have done for the Alps, the Vosges, the Black Forest, and other mountains of Central Europe.

Wanderbuch für die Insel Bornholm. Von Walter Bombe. Greifswald: Verlag und Druck von Julius Abel, 1896. Pp. 121. *Price M.* 3.

Probably few British tourists have visited Bornholm, for as regards scenery, the chief attraction to the ordinary tourist, this island cannot compete with its northern neighbours. To the geologist it is of interest as containing within a small area most of the formations of Southern Scandinavia, and the archæologist finds there many interesting remains—singular round churches and massive castles, besides graves, flint implements, etc., dating back to the Neolithic age. All these attractions are described briefly, but with sufficient detail to guide the visitor who wishes to investigate them, in this small volume; and the visitor to Bornholm, whatever be his object, would do well to take the *Wanderbuch* with him.

Oliver and Boyd's Edinburgh Almanac and National Repository for the Year 1897. Edinburgh: Oliver and Boyd. Pp. 1183. *Price* 6*s.* 6*d.*

This well-known almanac, now in its sixtieth year, hardly needs any introduction. As usual, a large amount of new information is added, especially regarding recent legal enactments and other subjects affecting Scotland. The chief events of the past year in foreign countries are also recorded. We have much satisfaction in stating that Mr. Hugh Cameron, who has edited this excellent almanac for nearly thirty years, is a Fellow and an original member of our Society.

NEW MAPS.

EUROPE.

EDINBURGH, LEITH, AND PORTOBELLO, Plan of ——, with suburbs, showing the Boundaries of the City and Royal Burgh of Edinburgh as extended by the Edinburgh Extension Act, 1896; also showing former Boundary. Scale 1 : 10560 = six inches to a mile. *W. and A. K. Johnston, Edinburgh.*

A wall map, clearly drawn and coloured, which should prove especially useful to those living or possessing property near the new boundaries.

ATLASES.

THE VICTORIA REGINA ATLAS: Political, Physical, and Astronomical, containing 200 Plates and complete Index. *Price* £1, 1*s.*

W. and A. K. Johnston, Edinburgh and London, 1897.

Thoroughly "up to date," this atlas (dedicated by permission to her Majesty) furnishes to the public of the later Victorian era full, precise, and graphic representations of those portions of the earth's surface most likely to be of interest. It is constructed on a new model. Instead of only containing maps of the various continents and countries of the globe, necessarily on a small scale, it gives us, on a large and legible scale, maps of specially interesting localities. The environs of London, the English, Scottish, and Irish lake districts, the environs of Paris, the French Riviera, the environs of various continental capitals (with plans of latter), the Suez Canal, and the Upper Nile, are some of the novelties referred to. India and Africa are not given as formerly in great indistinct masses, but in intelligible sections, whilst the maps of the United States and Canada are wonderfully detailed. Add to this brilliant arms and flags of all nations, and astronomical, climatological, and geological charts, and the difficulty would be to suggest anything, considering the price, which has been omitted. We observe only one misprint. At p. 85 Bosporus (ox-ford) is printed "Bosporous." The handy size of this atlas is a recommendation of itself.

L'ANNÉE CARTOGRAPHIQUE. Supplément annuel à toutes les Publications de Géographie et de Cartographie, dressé et rédigé sous la direction de F. Schrader. Sixième supplément. *Prix* 3 *Fr.*

Librairie Hachette et Cie, Paris.

The number containing cartographical illustrations of the explorations and frontier changes of 1895 is composed of three sheets. Perhaps the most interesting maps are those showing the routes of Prince Henri d'Orléans and Mr. Littledale. The "Région de Timbouctou" and the "Province de Catamarca et la Frontière Chilo-Argentine" may also be mentioned. On the latter the frontier is confessedly drawn from Argentine maps; at present the question is quite indeterminate.

These maps are invaluable for cartographers and those who study the geographical questions of the day. The execution is as neat as usual.

PLAN AND CHARTS.

DILLY, Plano do Porto e Cidade de ——. Levantado en 1870 por T. Andrea Cap^{ão} Tenente Com. da Corveta *D. João 1º* e T. Machado 2º Ten^{te} 2^{a} Edição, 1895.

LOANDA, Plano Hydrographico do Porto de ——. Escala 1 : 50,000. 2º Edicão 1896.

BAHIA DOS TIGRES, Plano da ——. Escala 1 : 120,000. 1896.

Commissão de Cartographia, Lisbon.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

CAPE JUBY.

By Fred. S. Zaytoun, M.B., C.M. (Ed.)

(Read before the Society at Edinburgh, in January.)

When, at the suggestion of a Member of the Society, I was invited to give a lecture on Cape Juby, I felt somewhat reluctant to accept the honour, as I have made no surveys on the coast of the Sahara or carried out any strictly scientific work. However, I spent five years at Cape Juby, having gone out with Mr. Donald Mackenzie, founder of the North-West African Company, at first in the capacity of interpreter, and subsequently as medical officer of the Company, and I sojourned for a time amongst the Kabyles of Algeria, and have therefore acquired some knowledge of the Sahara and its inhabitants, which may be interesting to a geographical society.

Though the Dark Continent has during the last fifty years been the scene of the labours of many noted explorers, the Sahara, the largest desert in the world, still remains one of the least-known regions of Africa. The first to cross the desert was the German, F. C. Hornemann, who travelled in 1800 from Tripoli to the Niger, and he was followed in 1822 by Denham and Clapperton, who made their well-known journey from Tripoli to Sokoto and back. On the Western Sahara our chief authority is Dr. Lenz, who in 1880 travelled in the disguise of a Mohammedan from Morocco to Timbuktu, and published a book, which has been translated into English and French. France has for several years been endeavouring to penetrate into the Sahara from the north, with the object of ultimately uniting Algeria with Senegambia by a trans-Saharan railway. The enterprise is one attended with great difficulties, arising both from the physical condition of the country and from the hostility of the inhabitants, especially the Tuaregs.

By ancient geographers the Sahara, which covers an area of 3,000,000 square miles between the Nile and the Atlas mountains, was supposed to be a vast plain of moving sand more terrible to encounter than the waves of the ocean, on which oases were scattered here and there like islands. It is now, however, becoming generally known that the Sahara is not entirely a desert, or everywhere flat. It is, on the contrary, traversed by mountain ranges, reaching at Asben a height of 5000 feet above sea-level (Timge). It contains verdant valleys in many of which there are groves of trees, and it is inhabited by a large population divided into several tribes or confederations, who have erected towns and engage in various branches of industry.

The country which we are now concerned with is the Western Sahara, stretching from the Ahaggar mountains and Adrar on the east to the Atlantic, and from the Atlas down to the Senegal. It is divided into several districts, each governed by an independent chief, the most important being Azawad, Adrar, El Haha and El Hodh. Its population is estimated at over two millions. Opposite the Canary Islands, in lat. 27° 56′ 41″ N. and long. 12° 56′ 10″ W. is situated Cape Juby, and from this point the coast trends north-westward up to the Wad Draa, while to Cape Bojador it follows a nearly southerly direction.

The littoral between the Wad Draa, the boundary of Morocco, and Cape Bojador, the northern limit of the Spanish territory of the Rio de Oro, is called Tekna, and is for the most part independent. Towards the north-east, however, it extends inland towards the Wad Nun, including the town of Glimim, which is subject to Morocco, the inhabitants paying tribute to the Sultan.

The Wad Draa, the largest river of North-West Africa, is formed by the union of the Idermi and Dads, two small streams which rise in the Atlas mountains to the north of Tafilet. It flows southward into the Sahara and then makes a bend to the west, entering the Atlantic about 100 miles to the north of Cape Juby. Its valley is very fertile and the inhabitants grow large quantities of barley and other cereals, dates, vegetables and fruits.

From the Wad Draa southwards there is no natural feature of any interest until the Boca Grande is reached, where the Shebika enters the sea, a river about 1000 feet broad. About 80 miles farther is Porto Cansado, formerly occupied by the Spaniards. Here is an old castle, with loopholed walls six feet thick. The mouth of the harbour is silted up and a tremendous surf breaks upon the shore. Porto Cansado is about forty miles from Cape Juby.

About fifty miles south of Cape Juby is situated the Sakiet el Hamra, or Red Channel. During ten months in the year its delta is shut off from the sea by sand-dunes, but in the rainy season the water finds its way through the sand by numerous runnels. By some the Sakiet is said to rise in the Hamada, or high tableland, while others affirm that it is an arm of the Draa. It runs in a bed sixty or seventy feet wide through a valley two or three miles in breadth. Here the tribes find good pasturage for their flocks and cultivate a few fields of barley. Some palm-trees are visible in the background.

The Rio de Oro, which I once visited in a schooner with a party of three, is situated above 300 miles south of Cape Juby. The intervening coast is alternately rocky and sandy. The mouth of the river, or, rather, creek, is generally one mile broad, with a maximum of two miles, and the creek extends about ten miles inland, flanked on both sides with cliffs twenty to forty feet high. On the north side of the mouth is a peninsula of considerable area, where the Spaniards established themselves in 1883. A detachment of forty soldiers now occupies the peninsula, being quartered in barracks surrounded by a wall. A Spanish trading company has also a factory here, but the business done is of little importance, as the natives are unfriendly.

The climate of Cape Juby is salubrious. On the north-west coast of Africa the excessive heat of the Sahara is modified by the cool north-north-east trade winds, which prevail during eight months out of the twelve. The air is pure, dry and clear, and the weather is not subject to sudden changes. The soil being dry, vegetable fermentation proceeds less rapidly than in many other places in the same latitude. Hence the diseases of hot and malarious districts, such as dysentery, intermittent and black-water fevers, are unknown, and during the twelve years Cape Juby was occupied by Europeans no case of fever occurred.

These favourable conditions of atmosphere and soil render Cape Juby a beneficial resort for patients suffering from lung diseases and rheumatic complaints. The climate is, indeed, very similar to that of the Canary Islands. The shade temperature rises above 80° F. only when the *Harmattan*, the hot wind from the desert, is blowing. This wind blows from the south-east between the months of October and February for two or three days at a time, and makes the atmosphere hazy. Meteorological observations taken at the castle, in connection with the Royal Meteorological Society, show that the difference between the summer and winter temperatures is small, and in this respect Cape Juby compares favourably with Madeira and the Canary Islands.

The dew at night is heavy, and at dawn the country is as wet as though a shower of rain had fallen. The rainy quarter is the south-west, and though rain sometimes falls when the wind near the earth blows from the north-east, the clouds are even then seen to be moving from the former direction. The mean range of atmospheric pressure is 0·694 inch. The barometer falls for south-east and south-west winds, and rises for west, north and north-west winds. For eight months in the year the wind blows from the north-north-east. In November and February it is more variable, but even then the north-east and north-east by north are the prevailing directions. Fogs and mists are rare and not of long duration, generally occurring in the morning and vanishing in the afternoon. Thunderstorms are also rare, but sheet lightning is seen from October to April.

The temperature of the sea is equable almost throughout the year, the mean being 63·4° F. The currents vary with the state of the tide and the direction of the wind; about one and a half to four knots an hour is their usual velocity.

In the interior, some four or five miles east of Cape Juby, is a plateau

called Aftut (red earth) by the natives, to which we often resorted for sport. If two guns went out they generally brought in about six brace of red-legged partridges and a few hares. To get a shot at a gazelle was a more difficult matter. The natives used to lie down behind bushes, wearing a headdress of the colour of the yellow sand, and send out men on camels to drive the gazelles towards them. Our excursions to Aftut were generally made on horseback, and sometimes we took a tent and spent the whole day in the country. When Baron Lahure, a Belgian official, was with us, he examined the plateau, and described it as a slightly undulating plain lying 200 to 300 feet above sea-level. Vegetable soil is abundant, and resembles both in composition and colour, which is due to the presence of iron oxide, that of Morocco and Andalusia. It rests on limestone rock, which in some places crops out above the surface. The admixture of lime adds to the natural fertility of the soil.

The vegetation consists of clumps of large, compact bushes, cactus, and other thorny succulent plants, which serve as forage for camels. Here also grow *Anafis*, the bark of which is used for tanning; henna, the shrub which yields the dye used by the native women to colour their foreheads, noses, and finger-nails; and orchilla, a parasitic plant, which also furnishes a beautiful dye. Some of these bushes grow as high as six to ten feet.

The district of Aftut extends for about twelve miles, with a breadth of five towards the sea, north of Cape Juby, and south-eastwards to the plains of Durah. The latter are about thirty miles in extent, and have a soil similar to that of Aftut. The inhabitants of these plains are mostly of the Azzerguiin tribe; besides their tents, they have two large buildings built of earth and clay, which are styled forts. Barley and corn are cultivated here. Mr. Mackenzie visited the country, and described it in an article in *Blackwood's Magazine*; it is about fifty miles from Cape Juby.

The rainfall in the Sahara is very small and irregularly distributed. I measured the fall at Cape Juby in 1894, and found it to be only three inches for the whole year. The supply of water is supplemented by the *wads* or rivers flowing down from the mountains, which furrow the surface in many directions. Though none of them now contains water all the year round, their beds rival in breadth the great rivers of Europe, thus indicating, as Mr. Silva White remarks in his *Development of Africa*, that in former times more favourable climatic conditions produced magnificent waterways.

The subsoil water is still remarkably abundant, and, especially near high land, is easily reached by sinking wells. The depth at which it is found varies according as the nature of the soil is favourable to infiltration or not. In the neighbourhood of Cape Juby it lay from three to ten feet below the surface. It was brackish, but the natives drank it freely, and the flocks of sheep and the camels were supplied from wells. We built the natives a substantial well of stone and lime. Those the natives dig are frequently choked up by the drifting sand. In the Sahara they are of the first importance. Caravan routes are determined by them, and

robbers lie in wait beside them to surprise travellers, but the wary Arab traders are usually prepared for their attacks. Oases are always found where the water reaches the surface, other conditions being favourable. It is not the composition of the soil which renders the desert barren, for sand, lime and gypsum, such as cover the Algerian Sahara, occur in the most fertile plains in the world; the presence or absence of water alone determines the condition of the country. In the desert of Gabes, writes Pryeweski, as soon as rain has fallen vegetation germinates under the influence of the sun's rays with extraordinary rapidity, and the arid plain is transformed into a smiling oasis. Then the antelopes flock to it to slake their thirst, and birds begin to sing; the nomads lead their flocks to pasture, and thus the oasis becomes animated.

Even the sand is not absolutely destitute of fertility. In Arabia I cultivated cucumbers on a plot of sandy soil with most satisfactory results; these plants subsist, of course, to a large extent on water, and mine were watered four times a day. Thus water is the great essential to fertility; reduce the rainfall by a few inches and the country becomes a steppe, which by the loss of a few inches more is transformed into a desert.

All around Cape Juby are what are called *sebekh* (plural of *sebkha*), which are depressions containing crystallised salt. To the south-east, 15 miles from Cape Juby, lies one called Sebka el Hamra about 400 yards long by 200 broad. On a journey to this *sebkha* we experienced the well-known illusion called mirage, imagining we saw a lake of bluish water. Wild boars were seen crossing the *sebkha*, and on our return journey we fell in with a herd of gazelles, and one of our party, going in pursuit of them, was lost and did not turn up again till the following day.

The salt pans of Taudeni and El Juf are very extensive, and have been worked for the last five hundred years. The salt is deposited in five different layers, of which the uppermost is almost worthless, while the fourth is the most valuable; the lowest is steeped in brine. It is quarried out in slabs, some as much as 3 feet long, 13 inches broad, and 3 inches thick, weighing about 65 lbs. each. They are sold in Timbuktu at the rate of £1 sterling per cwt. In El Juf there is a whole series of salt pans, one of which is about 30 miles long by 12 broad; 20,000 camel-loads of salt are extracted from it annually.

In 1876 Mr. Donald Mackenzie examined the north-west littoral, of which he writes as follows: "The most remarkable feature in the physical character of the Western Sahara is the vast plain or hollow called El Juf, which is said to extend from within twelve miles of the shore as far south as the region of Azawad and Walate, north of Timbuktu. The greatest length of the depression is given at about 500 miles, and the greatest breadth at 120 miles, the area being about 60,000 square miles. The breadth of El Juf is much greater in the south, but towards the north it contracts, terminating in the great channel called Sakiet el Hamra, which formerly connected it with the Atlantic Ocean. It is evident from investigation into the physical character of the region that the water was in course of time cut off from El Juf through the gradual accumulation of sand across the mouth of the

channel, and then the burning rays of the sun descending vertically on to the country converted the region into a salt desert."

Mr. Mackenzie proposed to admit the water of the Atlantic into the interior by making a navigable channel through the Sakiet el Hamra, and thus open up the region to commerce and civilisation, but his scheme found no support, and was never put into execution.

The domestic animals of the Western Sahara are camels, sheep, goats, horses, donkeys, and cattle; gazelles, antelopes, wolves, hyænas, ostriches, foxes, fennecs, jackals, wild boars, and leopards are the game. Here, as elsewhere, a harmony exists between the fauna and the soil. The camels, sheep, and reptiles have the yellowish hue of the sand—the result of natural selection. Again, the necessity of covering long distances in search of pasture has produced great length of limb; even the sheep have longer legs than those in this country. Perhaps the most distinctive feature is the ability to go a long time without water, which all the animals possess, and the camel in a marked degree. He can travel six to ten days without water, feeding on the acacia and other thorny bushes, and at the end of this time can drink more than one hundred pints of water. The camel of the Sahara is the dromedary, with one hump. To the natives this animal is indispensable; it carries them from place to place and supplies them with meat and milk. Many natives live upon camels' milk alone for nine months out of the twelve. A she-camel yields milk for ten months, supporting one person besides her own foal. Thus, if a man owns, say, three she-camels, he can wander about at will without the necessity of seeking food for his family. The ostrich also is peculiarly adapted for the desert; it feeds on the tops of certain shrubs and can live a long time without drinking. The gazelle is valued for its flesh, and its skin is tanned and manufactured into various useful articles.

The population of Tekna, within a radius of seventy or eighty miles from Cape Juby, may be estimated at 50,000. The people are Arabs and Berbers and their slaves. The inhabitants of Tekna are known collectively as the Ait el Jamal, and are divided into several small tribes, as the Ait el Hasan, and Ait Musa Wa-ali at Wad Nun to the north of Cape Juby, and the Azzerguïn, Yaggut, and Argibat between the Wad Draa and Sakiet el Hamra. The former two live in houses of clay and sun-dried bricks, while the others are nomads. Other tribes again occupy the Sakiet el Hamra. Some of these tribes are warrior or *Hassani*, others are peaceful, and others again *Zewaya* or neutral. The peaceful tribes pay blackmail to the Hassani. Commerce is the pursuit of all, and the peaceful tribes also engage in agriculture. The diet of the people is very simple, consisting chiefly of barley, dates, and milk, and their dress is a piece of blue cloth.

The men average 5 feet 10 inches in height. They are somewhat slender but have well-developed muscles. Their complexion is dark brown, and their hair strong, black, and curly. Their faces are in general pleasing, though they can on occasion assume a forbidding expression. They are strong and active men and possess astonishing powers of endurance and abstinence, being able to travel two days

without water. Their sight is excellent, and their faculty of observation is sharpened by travelling in a country where landmarks are scarce. The warriors, both young and old, wear their hair long, but young boys have the head shaved, except a long lock on the crown, left for Mohammed to pull them up to heaven by. The women have also dark complexions, oval faces, well-shaped foreheads, black eyes, and thick eyebrows. The mouth is small and the chin rather square. The lips are not over thick: the teeth are small and pearly white. The hands are small but hardened by work.

These Arabs and Berbers are hospitable, and pay great respect to the aged. On the other hand, they are treacherous, revengeful and cruel, and their word is not to be relied on. They understand very well what virtues are, but do not practise them. As to food, they must be called abstemious, though they can take sufficient food at one meal to last them more than twenty-four hours. As true followers of Mohammed, they are total abstainers. Being cut off from intercourse with the outer world, they have adhered to the most primitive forms of society and culture. We find them in three stages: the dwellers on the coast are fishermen; then come herdsmen; and, lastly, agriculturists.

A regular trade in slaves is carried on among the tribes of the Sahara, and with Morocco. Every man that has the means keeps one or more slaves; some own as many as fifty or sixty of both sexes. They are employed as household servants and concubines. A good slave looks after the sheep and camels, keeps order in the camp during his master's absence, and protects his master's property and person, being frequently more trusted than sons or wives. A profit is also obtained by the sale of the children of slaves.

Slaves are kidnapped in the Sudan, and, with other Sudanese products—ivory, gold-dust, and gum—are obtained by the Arab dealers in exchange for cloth, sugar, tea, beads, and salt. Their price ranges from a camel's load of salt to a few pieces of blue cloth. These slaves are then brought on camels or on foot for a distance of 800 or 1200 miles to the fairs held in Tinduf, Shingiti, Wad Nun, and Morocco, many perishing on the way from fatigue and want of water. At the fairs they fetch 80 to 100 dollars per head, according to their age and sex, female slaves commanding a higher price than male. The Arabs believe that God created the black men for their use, as set forth in the Koran. Owing to the energetic action of the British and Foreign Anti-Slavery Society, the slave-markets in the sea-ports of Morocco have been closed, but the trade is still carried on privately. It is to be hoped that the British Government will make an effort for the suppression of slavery in Morocco, and put an end to the abominable traffic in human beings, so repulsive to the best feelings of humanity.

Four routes cross the Sahara from the north of Africa to Timbuktu, starting from Tripoli, Tunis, Algiers, and Morocco. From Morocco the route runs through Tinduf, Taudeni, and Arauan; from Algiers traders pass through Insalah, Tuat, and Mabruk; and from Tripoli *viâ* Ghadames, Insalah, and Tuat. From Tripoli to Sokoto the stages are Ghadames, Ghat, Aïr, and Agades.

Her Majesty's Consul at Mogador writes in his report: "The *akabar*, or caravan from Morocco, is the largest that crosses the desert to Timbuktu. It starts once a year, about the month of October, from Tinduf on the confines of the desert, and amounts to over 10,000 camels. Only 20 per cent. leave that station laden with goods; the others proceed to Taudeni, in the centre of the desert, where they are laden with salt for the Sudan. There are, besides, many small *akabars* which cross the desert during the year, averaging 100 camels each. The merchandise carried by these caravans consists of the following goods: blue cloth, American cloth, long cloth, sugar, tea, glass beads, amber beads, shells, and silk, from Fez and Morocco; gold, ostrich feathers, Senegal gum, gum-Arabic, frankincense, blankets, and slaves from the Sudan.

"The average value of the merchandise carried by each camel is £50. The approximate value, therefore, of the goods conveyed by the great *akabar* is £100,000; add to this sum £30,000, the value of the small caravans, and the total value of the merchandise sent yearly from Morocco to Timbuktu is £130,000. Upon this sum a profit of 75 per cent. is made by the traders, besides the gains on the salt carried from Taudeni to Timbuktu. 60 per cent. of the camels are sold at that place, as comparatively few are required for the returning with the light Sudan goods. At Timbuktu the great caravan is broken up, and the traders return in small parties to their respective homes by different routes."

The journey from Wad Nun to Timbuktu occupies twenty-eight days with dromedaries, and sixty days with ordinary camels.

The trade at Cape Juby consisted chiefly in the barter of blue and white cotton cloth, etc., for the wool yielded by the large flocks of sheep that pasture in the vicinity.

BALFOUR SHOAL:

A Submarine Elevation in the Coral Sea.

By John Murray, F.R.S., of the *Challenger* Expedition.

During the past few years Her Majesty's surveying ships have been carrying out, under the directions of Admiral Wharton, C.B., F.R.S., Hydrographer of the Admiralty, some most important surveys in the South-Western Pacific, particularly in the region lying between the latitude of New Guinea and the Solomon Islands in the north and the latitude of New Zealand in the south, extending across from the east coast of Australia eastward to beyond the Samoa, Friendly, and Kermadec groups of islands. These observations have a special interest for all who are engaged in the study of oceanographical problems.

In this region of the ocean over two thousand trustworthy soundings have now been recorded in depths exceeding 100 fathoms, nearly one-half of which have been taken in depths exceeding 1000 fathoms. These numerous deep-sea soundings have very much increased our knowledge of the bathymetrical contours of the sea-bed in this part of the ocean,

and show that the sea-bottom is very irregular; it is proposed in another paper to deal with them in detail. A feature of great interest, however, has been the development of a very deep trough, running in a north-north-east direction to the eastward of the Kermadec and Friendly Islands, which is, so far as yet known, the most depressed point on the surface of our planet. In the bathymetrical maps published in the *Challenger* Summary volumes this trough is called the Aldrich Deep, and in some German maps [1] recently published it is called the South Pacific Deep.

A sounding of 2900 fathoms taken by the *Challenger* in this locality in July 1874 indicated that the bottom lay far beneath the surface. In the summer of 1888 Captain Pelham Aldrich, in H.M.S. *Egeria*, obtained to the westward of the *Challenger* position depths of 4295 and 4428 fathoms. In the following year Commander Oldham, then in command of the *Egeria*, took a sounding in 4530 fathoms, about eight degrees farther north, which was the greatest depth known up to that time south of the equator. Six years later, on 23rd July 1895, Commander Balfour, in H.M.S. *Penguin*, in lat. 23° 39·5′ S., long. 175° 2·8′ W., made two attempts to sound, but each time the wire parted when running out, first at 4320 fathoms, and then at 4900 fathoms; a few months later in the same position he obtained a depth of 5022 fathoms. Again, on 30th December 1895, Commander Balfour sounded in 5147 fathoms, five degrees to the south of his previous sounding (in lat. 28° 44·4′ S., long. 176° 4′ W.), and on the next day, still a little farther south (in lat. 30° 27·7′ S., long. 176° 39′ W.), he obtained the deepest sounding hitherto recorded in the ocean. The depth is 5155 fathoms, or 250 yards less than six miles. In this deep trough, then, we have seven soundings in depths exceeding 4000 fathoms, three of which exceed 5000 fathoms; in what is possibly the same trough there are, in addition, twenty-eight soundings in depths between 3000 and 4000 fathoms.[2]

The numerous temperature observations taken in this region of the ocean, both in intermediate waters and at the bottom, promise, when fully worked out and discussed, results of very great interest.

Through the kindness of Admiral Wharton, I have been permitted to examine the samples of the marine deposits collected by the surveying officers in the Western Pacific. The samples brought up from the deep trough noted above are all Red Clays, and are in almost all respects identical with the deposit obtained by the *Challenger* in 2900 fathoms, consisting for the most part of very minute particles of pumice and other volcanic particles, many of them passing into palagonite. Carbonate of lime shells are wholly absent, and of siliceous organisms there are only a few broken specimens.

In this paper, however, I purpose specially to direct attention to a limited number of these soundings in a quite restricted area, and to a remarkable submarine elevation rising from the floor of the ocean, discovered by Commander Balfour while searching for the Ocean Ranger Reef. In the year 1891 the master of the barquantine *Ocean Ranger*

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[1] Deutsche Seewarte: *Stiller Ozean, ein Atlas von* 31 *Karten*. Hamburg, 1896.

[2] See Lists of Oceanic Depths received at the Admiralty (blue-books published annually).

reported to the New Zealand Government that, "on the passage from Townsville (Queensland) to Chesterfield islets, he sighted a dangerous reef (*Ocean Ranger reef*), extending 2 or 3 miles in a S.S.E. and N.N.W. direction, and on which the sea broke heavily. Observations deemed reliable place this danger in approximately lat. 18° 44′ S., long. 157° 2′ E., or with North Elbow, Bampton reefs, bearing about E. ¼ S., distant 84 miles."[1]

In August and September 1894, Commander Balfour, in H.M.S. *Penguin*, searched unsuccessfully for this danger, and it has therefore been expunged from the charts. Commander Balfour obtained, however, a considerable number of rather deep soundings in this neighbourhood, which are interesting from another point of view than that of navigation, for they develop a remarkable rising of the bottom above the general level of the sea-bed. This elevation perhaps hardly deserves the name of a "bank" or "shoal," for the shallowest depth obtained was 836 fathoms, but I have given it the name of Balfour Shoal, after its discoverer. Several of the surveying officers point out as a remarkable fact that over a submarine cone as deeply submerged as that of the Balfour Shoal there is frequently a ripple or other disturbance at the surface of the sea. This is apparently due to some massive movement of the water, of which at present we have little definite information.

The position and form of this peculiar cone-like elevation are shown on Plate I. by means of contour lines indicated by the soundings. These contour lines show rather steep slopes towards the north-east, whereas towards the south-west the slopes are more gentle. The maximum slope to the north-east is about 200 fathoms per mile, or 1 in 4·4. Although this is a rather steep submarine slope, steeper ones have been recorded,[2] for instance:—

Dacia Bank, North Atlantic, to the west of Africa,	1 in 3·1.
Seine Bank, do. do., . .	1 in 2·05.
Shoal discovered by the *Tuscarora* to the westward of San Francisco (32° 55′ N., 132° 30′ W.),	1 in 2·7.

Mr. Buchanan records a gradient of 642 fathoms per mile off the west coast of Africa (lat. 0° 26·5′ N., long. 6° 38·7′ E.), which is equal to a slope of 1 in 1·4.

The angle of the maximum slope off the Balfour Shoal is 14°, and Mr. Buchanan[3] records larger angles of slopes, as follows:—

Dacia Bank, . . .	43°
Seine Bank, . . .	23°
Off Bermuda, . . .	42°
Challenger Bank, near Bermuda, .	40°

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[1] Admiralty Notice to Mariners, No. 110, 1892.

[2] See J. Y. Buchanan, "On the Land Slopes separating Continents and Ocean Basins, especially those on the West Coast of Africa,"—*Scot. Geogr. Mag.*, vol. iii. p. 217, 1887; also G. W. Littlehales, "The Average Form of Isolated Submarine Peaks,"—U.S. Navy, Hydrographic Office, No. 95, Washington, 1890.

[3] "On Oceanic Shoals discovered in the s.s. *Dacia* in October 1883."—*Proc. Roy. Soc. Edin.*, vol. xiii. p. 440.

The Dacia Bank is precipitous in some places, and the same is the case with the "Coral Patch," situated in the same locality, which is referred to in the sequel.

The serial temperatures obtained by Commander Balfour in this part of the ocean are represented diagrammatically on Plate II., the vertical scale being to the horizontal as 1 to 22. It will be observed that the temperature at the surface ranges from 73° to 75° F., and on the summit of the shoal, in 884 fathoms, the temperature is 37·1° F. At the base of the cone, in 1758 fathoms, the bottom temperature is 35·0° F. In the deep trough to the east of the Fiji Islands the bottom temperature is in one instance recorded as low as 31·8° F.

Many submarine cones, similar to the one now under consideration, have been discovered by soundings in different regions on the floor of the ocean. In no case, however, has such a complete series of the deposits been preserved and sent home from different depths around the cone as in the work carried out in this instance by Commander Balfour. I have therefore submitted these deposits to a careful microscopical and chemical examination.

The deposits on this cone-like elevation are very different from those to which I have just referred as having been procured in the greater depths of the ocean beyond 3000 fathoms. At these great depths there is no carbonate of lime in the deposits; all the carbonate of lime organisms, which are abundant in the surface waters, are dissolved before they reach the bottom in depths of four and five miles. In the deposits on and around this Balfour Shoal, where the depths range from 836 to nearly 2000 fathoms, all the carbonate of lime organisms which flourish in the surface waters are represented in the deposits by their dead shells and skeletons.

The analyses of the samples from the Balfour Shoal show that these deposits contain a very large quantity of carbonate of lime, ranging from 88·7 per cent. on the summit to 71·9 per cent. in the deeper water at the base of the cone. The decrease in the quantity of carbonate of lime with increase of depth is not quite regular; still, a general fall in the percentage of lime is clearly indicated from shallower to deeper water. As might be expected in such a circumscribed area, there is a great uniformity both in the chemical composition and relative abundance of the organic and inorganic constituents of the deposits.

In all cases the carbonate of lime is almost wholly made up of the dead shells which have fallen from the surface waters—belonging to Plankton organisms—such as Pteropods, Heteropods, pelagic Foraminifera, coccoliths, and rhabdoliths; probably not more than 2 or 3 per cent. of the carbonate of lime in these deposits has been secreted by bottom-living organisms or animals belonging to the Benthos.[1] It is very interesting to note that in all the shallower soundings—those on the summit of the cone in depths of less than 1000 fathoms—the Pteropod and Heteropod shells are relatively abundant, and these deposits are in

[1] See Table II., showing the genera of bottom-living Foraminifera observed in these deposits, p. 126.

consequence called PTEROPOD OOZES. In the map (Plate I.) the summit of the bank covered by Pteropod Ooze is indicated by a distinctive colour, the slopes and deep water around the bank covered by Globigerina Ooze being indicated in shades of blue. In these same deposits the thin delicate species of pelagic Foraminifera, such as *Globigerina digitata*, *Hastigerina pelagica*, and *Candeina nitida*, are likewise present, while they, as well as the Pteropod and Heteropod shells, disappear almost completely from the deposits procured from the greater depths beyond 1500 fathoms. With the disappearance of these thin and more delicate pelagic shells from the deposits, there is a corresponding diminution in the percentage of carbonate of lime in the greater depths. Had the depths immediately surrounding the Balfour Shoal reached 3000 or 4000 fathoms, the whole of these pelagic carbonate of lime shells would have disappeared from the deposits, and we should then have had a Red Clay similar to that procured from the Aldrich Deep to the east of the Kermadec and Friendly Islands.

In depths beyond 1000 fathoms around the Balfour Shoal, the deposits are typical GLOBIGERINA OOZES. The most abundant species are *Orbulina universa*, *Globigerina bulloides*, *Globigerina conglobata*, *Pullenia obliquiloculata*, and *Pulvinulina menardii*; indeed, I estimate that these five species and their broken down parts make up fully 50 per cent. of the whole deposit.[1] In all these deposits—both the Pteropod and Globigerina Oozes—the calcareous shells were in very many cases discoloured brown or black by depositions of the peroxide of manganese; the *Globigerina* shells were often covered with little black grains of this substance, which gave them a mottled, and sometimes even a jet-black, appearance.

After the removal of the carbonate of lime from the deposits by dilute hydrochloric acid, the residue was found to consist for the most part of minute fragments of pumice. These ranged from macroscopic fragments 4 to 5 mm. in diameter down to the most minute splinters. Small fragments of palagonite and grains of manganese peroxide were also present. In some cases there were minute rounded fragments of quartz, covered with a red oxide of iron. These quartz particles are similar in all respects to those found in the Atlantic, which are believed to have been borne by wind from the Sahara; probably they came in like manner from the deserts of Australia.

In the residue there were always a few siliceous organisms, such as spicules of Sponges, Radiolaria, and a few Diatoms; it is estimated that these make up from 2 to 3 per cent. of the deposits. In some cases there were a few brown-coloured casts of the Foraminifera in the residue, but these were not nearly so abundant as in some samples of Globigerina Ooze procured by the *Challenger* in the same region and at about the same depth—for instance, between the Fijis and New Hebrides.[2]

On the north-east steep side of the Balfour Shoal there were indications that depositions of manganese peroxide were more abundant than

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[1] See Table I., showing the relative abundance of the species of pelagic Foraminifera, p. 125.

[2] See *Challenger* Report on *Deep-Sea Deposits*, page 176.

TABLE I.

SHOWING THE RELATIVE ABUNDANCE OF THE SPECIES OF PELAGIC FORAMINIFERA IN THE VARIOUS DEPOSITS.

	I. 836 fms.	II. 974 fms.	III. 1000 fms.	IV. 1060 fms.	V. 1163 fms.	VI. 1186 fms.	VII. 1192 fms.	VIII. 1227 fms.	IX. 1343 fms.	X. 1402 fms.	XI. 1515 fms.	XII. 1552 fms.	XIII. 1568 fms.	XIV. 1642 fms.	XV. 1740 fms.	XVI. 1758 fms.	XVII. 1798 fms.	XVIII. 1845 fms.	XIX. 1965 fms.
1. *Orbulina universa*,	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.
2. *Globigerina bulloides*,	v.m.	v.m.	v.m.	m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.
3. ,, *rubra*,	m.	f.	m.	f.	f.	m.	f.	m.	m.	f.	f.	f.	f.	m.	f.	m.	m.	m.	f.
4. ,, *conglobata*,	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.
5. ,, *dubia*,	v.m.	m.	v.m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	v.m.	m.
6. ,, *inflata*,	f.	m.	m.	f.	m.	f.	f.	f.	f.	f.	v.f.	f.	f.	f.	m.	f.	v.m.	f.	v.f.
7. ,, *sacculifera*,	m.	m.	m.	m.	m.	m.	m.	m.	m.	f.	m.	m.	m.	m.	m.	m.	m.	m.	m.
8. ,, *digitata*,	...	...	...	v.f.	v.f.	...	...	v.f.	v.f.	v.f.	v.f.	v.f.	v.f.	v.f.	...	v.f.	v.f.	v.f.	v.f.
9. ,, *æquilateralis*,	m.	f.	m.	m.	m.	m.	m.	f.	m.	f.	f.	m.	f.	f.	m.	m.	f.	f.	f.
10. *Hastigerina pelagica*,	v.f.	...	...	...	...	v.f.	...	v.f.	v.f.	...	...	v.f.	...	...	...	...	...	...	...
11. *Candeina nitida*,	f.	f.	f.	f.	v.f.	f.	f.	v.f.	v.f.	f.	v.f.	v.f.	v.f.	v.f.	v.f.	v.f.	v.f.	v.f.	...
12. *Sphæroidina dehiscens*,	m.	m.	f.	m.	m.	f.	f.	f.	f.	f.	f.	m.	f.	f.	m.	m.	m.	f.	m.
13. *Pullenia obliquiloculata*,	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.
14. *Pulvinulina menardii*,	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	v.m.	f.	v.m.	v.m.	v.m.	v.m.
15. ,, *tumida*,	m.	m.	m.	v.m.	f.	f.	f.	f.	f.	f.	f.	f.	f.	f.	v.f.	f.	f.	f.	m.
16. ,, *canariensis*,	v.m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	v.m.	m.	m.	m.	m.
17. ,, *crassa*,	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	v.m.	m.	m.	m.	m.
18. ,, *micheliniana*,	v.m.	v.m.	v.m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	v.m.	m.	m.

v.m. = very many. m. = many. f. = few. v.f. = very few.

TABLE II.

SHOWING THE GENERA OF BOTTOM-LIVING FORAMINIFERA OBSERVED IN THE VARIOUS DEPOSITS.

	I. 836 fms.	II. 974 fms.	III. 1000 fms.	IV. 1060 fms.	V. 1163 fms.	VI. 1186 fms.	VII. 1192 fms.	VIII. 1227 fms.	IX. 1343 fms.	X. 1402 fms.	XI. 1515 fms.	XII. 1552 fms.	XIII. 1568 fms.	XIV. 1642 fms.	XV. 1740 fms.	XVI. 1758 fms.	XVII. 1798 fms.	XVIII. 1845 fms.	XIX. 1965 fms.
Biloculina,	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Spiroloculina,	*	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...
Miliolina,	*	*	*	*	*	*	*	*	*	*	*	*	*	...	*	...	...	*	*
Textularia,	...	*	*	*	*	...	*	*	*	*	...	*	*	*	*	...	...	*	...
Verneuilina,	...	...	...	...	*	*	*	...	*	..	...	...	...	...	...	...	..	...	...
Gaudryina,	*	...	...	*	...	*	*	...	*	...	...	...	*	...	...	...	...	...	...
Bulimina,	*	...	*	...	...	...	...	*	...	...	...	...	...	...	...	...	...	*	...
Bolivina,	*	...	...	*	...	...	...	...	...	...	...	...	...	...	..	...	*	...	...
Cassidulina,	*	*	*	...	*	*	*	*	*	*	..	*	*	*	...	...	...	*	*
Ehrenbergina,	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagena,	*	*	*	*	*	*	*	*	...	*	...	*	*	*	*	...	*	*	*
Nodosaria,	*	...	...	*	..	*	*	...	*	...	*	...	*	...	*	...	*	..	...
Cristellaria,	...	...	*	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...
Polymorphina,	*	...	...	*	.	*	*	*	...	*	...	*	...	*	...	...	*	...	...
Uvigerina,	*	*	*	*	...	...	*	...	*	*	...	*	*	*	...	...	*	..	...
Pullenia quinqueloba,	*	...	...	...	...	...	...	*	...	*	...	*	...	*	...	...	*	...	...
,, *sphæroides*,	*	*	*	..	*	*	...	*	...	*	*	...	...	*	...	...	...	...	...
Sphæroidina bulloides,	...	...	...	...	...	...	...	...	*	...	...	...	...	...	...	...	*	..	...
Truncatulina,	*	*	*	*	*	*	*	*	*	*	...	*	*	...	*	*	*	*	*
Pulvinulina elegans,	*	...	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
,, *exigua*,	...	*	...	...	...	...	...	...	...	...	...	...	*	...	...	..	...	...	...
,, *favus*,	...	...	...	...	...	*	...	...	...	*	*	...	...	*	...	*	...	...	...
,, *pauperata*,	...	*	...	...	...	*	*	...	*	*	...	...	*	...	*	...	...	...	...
Rotalia,	*	*	...	*	*	*	*	...	...	...	..	*	*	...	*	*	*	*	*
Nonionina,	*	...	...	...	*	...	*	...	*	*	*	*	*	*	*	...	*	*	*
Polystomella,	...	...	...	...	...	...	...	...	..	...	...	*	...	...	...	..	*	...	...

These bottom-living forms are all rare; often only a single representative was observed in the large quantity of material examined, and very seldom more than half-a-dozen examples. The species are given for those genera which contain pelagic representatives.

elsewhere. In 1549 fathoms several small pieces of a very fine-grained tuff covered with manganese peroxide were procured. Again, in 1645 fathoms, there was an angular fragment of a mottled yellowish jasper coated with manganese peroxide, and in 1570 fathoms there were three characteristic spherical black manganese nodules from one-half to three-fourths of an inch in diameter, quite similar to those procured by the *Challenger* in many areas of the Pacific and Atlantic. In one of these nodules the nucleus was a sub-angular fragment of a light-coloured augite-granophyre (see pages 132 and 133).

We are now acquainted with many instances of manganese peroxide occurring in the deposits about the steep slopes of oceanic islands, whether these be composed of coral or of volcanic material,—for instance off Christmas Island in the Indian Ocean, off Teneriffe, and other islands. Mr. Buchanan mentions a bank or "Coral Patch" in the Eastern Atlantic, on which the depth was 435 fathoms. On the western side the bank seemed to fall away precipitously from 550 to 835 fathoms; in one sounding on this ledge the sinker distinctly struck bottom in 550 fathoms, then tumbled over and continued to sink, struck in 620 fathoms, and again tumbled over, and finally found a resting-place in 835 fathoms. When hauled up the sinker had a large blackish-brown streak on it, having evidently struck obliquely on masses of manganese peroxide.[1] It seems evident that on the steep slopes of these oceanic islands large surfaces of volcanic rock are exposed to the action of sea-water, and are slowly decomposed and altered. The manganese which is deposited in the form of peroxide on the shells and other objects in the neighbourhood of such a cone was doubtless originally derived from the decomposition of the volcanic materials, which in the first instance formed this conical elevation on the sea-bed.[2]

In my papers on the Structure and Origin of Coral Reefs and Islands,[3] I have pointed out that volcanic mountains rise from the sea-floor to varying heights; some of them rise above the surface of the ocean and appear as islands, while others which may at one time have appeared as islands have been reduced by wave action to a depth of several fathoms beneath the surface of the sea. Again, the tops of others may be deeply submerged, for instance, like the "Coral Patch" in the Atlantic, 435 fathoms, or like the Balfour Shoal, 836 fathoms, beneath the surface. These latter, I have maintained, might in process of time be built up to the surface by depositions of pelagic shells on the summit, and by the accumulation of the remains of Benthos organisms; so that ultimately they might form the base on which true coral atolls might be formed by the agency of reef-forming species. From the examination of the samples from the Balfour Bank or Shoal, it is evident that the deposits on the summit are growing at a more rapid rate than those on the slopes, but we have no definite notion as to the rate of that increase. In the samples from the summit of the Balfour Shoal we have no indications

[1] Buchanan, *Proc. Roy. Soc. Edin.*, vol. xiii. p. 431.

[2] See Murray and Irvine "On the Manganese Oxides and Manganese Nodules in Marine Deposits."—*Trans. Roy. Soc. Edin.*, vol. xxxvii. p. 736, 1894.

[3] *Proc. Roy. Soc. Edin.*, vol. x. p. 505, 1880; *Proc. Roy. Institution*, March 16, 1888.

of any abundant growth of Benthos species, though there have been as yet no dredgings thereon; but on the Coral Patch, in 530 fathoms, Mr. Buchanan obtained a very large quantity of growing Coral—*Lophohelia prolifera*—and several specimens of Comatula—*Antedon*. It is to be hoped that, when opportunity again occurs, other surveyors will follow Commander Balfour's example, and make a careful collection of the deposits on the summit and slopes of these submarine cones, for we still require much information about the changes which are taking place in such situations, and of the variations in the composition of the deposits with varying depth.

Descriptions of the Deposits on and around the Balfour Shoal.

The plan adopted in the examination and description of the deposit samples collected by the *Challenger*[1] has been followed in dealing with the deposits from the neighbourhood of the Balfour Shoal. Each sample was divided into two portions, one of which was washed and prepared for microscopic examination, after the macroscopic characters had been noted, the other being used for the quantitative determination of the percentage of carbonate of lime.

In the descriptions the particulars as to date, position, and depth are first given. The name of the deposit follows in dark type, thus: **Globigerina Ooze**, with an indication of the colour and other macroscopic characters. Under the heading Calcium Carbonate, in small capitals, are given (1) the percentage of carbonate of lime as determined by chemical analysis in parentheses; and (2) the different kinds of calcareous organisms arranged usually in the order of their relative abundance. The Residue is the complement of the Calcium Carbonate, and the percentage is given in parentheses, followed by an indication of the colour. The Residue was divided by decantation into three portions, viz., (1) *Minerals*, (2) *Siliceous Organisms*, and (3) *Fine Washings*, the percentage of each of which was estimated by inspection. These estimated percentages are inserted in the descriptions within square brackets, to distinguish them from the figures given for the percentages of Calcium Carbonate and of Residue, which are the result of quantitative determinations. Under the heading *Minerals*, following the estimated percentage, the average size of the mineral particles in millimetres is occasionally indicated thus: m.di. 0·06 mm.; the mineral species observed are then enumerated in the order of their relative abundance. Under the heading *Siliceous Organisms*, following the estimated percentage, the remains of silica-secreting organisms (such as Diatoms and Radiolarians) are mentioned in the order of relative abundance. The Fine Washings include all the finest non-calcareous particles of the deposit, which pass off with the first decantations, and consist principally of amorphous clayey matter coloured by the oxides of manganese and iron, but contain also minute indeterminable fragments of minerals and siliceous organisms, as indicated under the heading *Fine Washings*, following the estimated percentage.

H.M.S. PENGUIN.

Sounding 87, 12th August 1894, lat. 18° 56·2′ S., long. 156° 57·8′ E., 836 fathoms.

Pteropod Ooze, of a fawn colour. This sounding appears to represent the summit of the bank.

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[1] See *Challenger* Report on *Deep-Sea Deposits*, 1891.

Calcium Carbonate (88·7%), many Pteropods, mostly in a fragmentary condition, only the small shells being approximately perfect, many small Lamellibranch and Gasteropod shells, a few Heteropod shells, pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, otoliths, coccoliths, rhabdoliths, a few spherical crystalline aggregations. Some of the shells discoloured (brown or black) by manganese.

Residue (11·3%), brown.

Minerals [1%], a few pumice fragments and small black spherules (manganese ?).

Siliceous Organisms [2%], Sponge spicules, Radiolaria, and fragmentary arenaceous Foraminifera.

Fine Washings [8·3%], amorphous clayey matter and minute mineral particles.

Sounding 88, 12th August 1894, lat. 19° 3·3′ S., long. 156° 56·5′ E., 974 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (87·6%), pelagic and bottom-living Foraminifera, a few shells and fragments of Pteropods, Heteropods, Cirripeds and Gasteropods, Echini spines, Ostracodes, otoliths and teeth of fishes, coccoliths, rhabdoliths (numerous), one or two small spherical crystalline aggregations. Some of the Foraminiferous shells discoloured by manganese.

Residue (12·4%), brown.

Minerals [1%], a few minute pumice and glassy particles, fragment of volcanic glass (1 mm. in diameter) with imbedded crystals of felspar.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms, fragments of arenaceous Foraminifera, one or two imperfect casts.

Fine Washings [8·4%], amorphous clayey matter and minute mineral particles.

Sounding 94, 12th August 1894, lat. 18° 52·1′ S., long. 156° 41·7′ E., 1000 fathoms.

Pteropod Ooze, of a fawn colour.

Calcium Carbonate (86·4%), pelagic and bottom-living Foraminifera, shells and fragments of Pteropods, Heteropods, Gasteropods and Lamellibranchs, Ostracodes, Echini spines, otoliths, coccoliths, rhabdoliths, spherical crystalline aggregations. Many of the shells, etc., are discoloured by manganese, some being uniformly brown, others with brown or black spots, and one small shell of *Globigerina bulloides* is jet black.

Residue (13·6%), brown.

Minerals [2%], pumice, mostly in small fragments, though two or three pieces 1 to 2 mm. in diameter were observed.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera, imperfect casts.

Fine Washings [8·6%], amorphous clayey matter with minute splinters of pumice.

Sounding 162, 21st November 1895, lat. 18° 11·5′ S., long. 155° 34·7′ E., 1060 fathoms.

Globigerina Ooze, fawn colour, granular.

Calcium Carbonate (79·5%), pelagic and bottom-living Foraminifera, fragments of Pteropods, Heteropods, Lamellibranchs, Gasteropods and Polyzoa,

Ostracodes, otoliths, Echini spines, coccoliths, rhabdoliths, crystalline aggregations.

Residue (20·5%), brown.

Minerals [3%], pumice, manganese grains, palagonite, quartz (an angular crystal 0·8 mm. in diameter observed); there is a fragment of soft weathered rock, dark red-brown in colour, 5 mm. in diameter.

Siliceous Organisms [2%], Radiolaria, Sponge spicules, fragments of arenaceous Foraminifera.

Fine Washings [15·5%], amorphous clayey matter and minute mineral particles.

Sounding 95, 13th August 1894, lat. 18° 52′ S., long. 156° 33·5′ E., 1163 fathoms.

Globigerina Ooze, of a fawn colour, granular.

Calcium Carbonate (88·7%), pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, otoliths and teeth of fishes, coccoliths, rhabdoliths.

Residue (11·3%), brown.

Minerals [1%], pumice, quartz (angular crystal 0·5 mm. in diameter, and a few small rounded grains covered with ologist), manganese grains, glassy particles.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [8·3%], amorphous clayey matter and minute mineral particles.

Sounding 93, 12th August 1894, lat. 18° 59·5′ S., long. 156° 43·3′ E., 1186 fathoms.

Globigerina Ooze, of a fawn colour, granular.

Calcium Carbonate (84·9%), pelagic and bottom-living Foraminifera, fragments of Pteropods and Heteropods, Echini spines, Ostracodes, otoliths, Cirriped fragments, coccoliths, rhabdoliths.

Residue (15·1%), brown.

Minerals [2%], pumice (one fragment 3 mm. in diameter observed), glassy particles, palagonite, quartz (small rounded grains covered with ologist). Most of the mineral particles are less than 0·05 mm. in diameter.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [10·1%], amorphous clayey matter and minute mineral particles.

Sounding 89, 12th August 1894, lat. 19° 10·2′ S., long. 156° 54·9′ E., 1192 fathoms.

Globigerina Ooze, fawn.

Calcium Carbonate (85·5%), pelagic and bottom-living Foraminifera, Pteropod fragments, Ostracodes, Echini spines, otoliths and teeth of fishes, coccoliths, rhabdoliths.

Residue (14·5%), brown.

Minerals [2%], pumice (one or two pieces 5 to 7 mm. in diameter), magnetite, glassy particles, palagonite, quartz.

Siliceous Organisms [3%], Sponge spicules, arenaceous Foraminifera, Radiolaria.

Fine Washings [9·5%], amorphous clayey matter and minute mineral particles.

Sounding 91, 12th August 1894, lat. 19° 6·1′ S., long. 156° 49·9′ E., 1227 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (82·0%), pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, otoliths and teeth of fishes, one or two fragments of Pteropods, Heteropods, and Lamellibranchs, coccoliths, rhabdoliths.

Residue (18·0%), brown.

Minerals [2%], principally pumice, glassy particles, palagonite, quartz.

Siliceous Organisms [4%], Sponge spicules, Radiolaria, arenaceous Foraminifera, Diatoms, imperfect casts.

Fine Washings [12%], amorphous clayey matter and minute mineral particles.

Sounding 90, 12th August 1894, lat. 19° 11·5′ S., long. 156° 49·1′ E., 1343 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (85·5%), pelagic and bottom-living Foraminifera, Echini spines, Ostracodes, otoliths, one or two Heteropod fragments, coccoliths, rhabdoliths; a few of the shells discoloured by manganese.

Residue (14·5%), brown.

Minerals [2%], pumice, glassy particles, palagonite, small rounded quartz grains covered with ologist.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, arenaceous Foraminifera, imperfect casts.

Fine Washings [9·5%], amorphous clayey matter and minute mineral particles.

Sounding 102, 14th August 1894, lat. 18° 42·3′ S., long. 156° 42·5′ E., 1402 fathoms.

Globigerina Ooze, fawn colour.

Calcium Carbonate (83·4%), pelagic and bottom-living Foraminifera, one or two fragments of Pteropods and Heteropods, Echini spines, Ostracodes, otoliths and teeth of fishes, coccoliths, rhabdoliths (numerous). Some of the Foraminifera shells are discoloured (brown or black) by manganese.

Residue (16·6%), brown.

Minerals [1%], pumice (one fragment 1 mm. in diameter observed), but nearly all the mineral particles are less than 0·05 mm. in diameter.

Siliceous Organisms [5%], Sponge spicules, Radiolaria, and arenaceous Foraminifera fragments.

Fine Washings [10·6%], amorphous clayey matter and minute mineral particles.

Sounding 124, 8th September 1894, lat. 18° 45′ 36″ S., long. 157° 35′ E., 1515 fathoms.

Globigerina Ooze, of a pale fawn colour.

Calcium Carbonate (79·7%), pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, otoliths and teeth of fishes; one Heteropod shell observed.

Residue (20·3%), brown.

Minerals [3%], pumice (one piece 4 mm. in diameter observed), volcanic glass, quartz.

Siliceous Organisms [4], Sponge spicules, Radiolaria, Diatoms, fragments of arenaceous Foraminifera, imperfect casts.

Fine Washings [13·3], amorphous clayey matter and minute mineral particles.

Sounding 99, 13th August 1894, lat. 18° 44·8′ S., long. 156° 59·6′ E., 1549 fathoms.

The sounding tube brought up a few small pieces of tufa, soft and of a dirty yellow colour, coated more or less with oxide of manganese.

Sounding 113, 16th August 1894, lat. 19° 50·8′ S., long. 156° 54·6′ E., 1552 fathoms.

Globigerina Ooze, fawn colour, granular, with macroscopic pieces of pumice (the largest 4 mm. in diameter).

Calcium Carbonate (79·4), pelagic and bottom-living Foraminifera (with a good many young forms), one or two Pteropod fragments, Echini spines, Ostracodes, Alcyonarian spicules, otoliths (one very large, corroded, and coated with manganese), coccoliths, rhabdoliths (numerous).

Residue (20·6%), brown.

Minerals [2], m.di. 0·06 mm., pumice, rounded grains of quartz covered with ologist, glassy and coloured particles. Except the pieces of pumice, nearly all the mineral particles are less than 0·05 mm. in diameter.

Siliceous Organisms [4], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [14·6], amorphous clayey matter and minute minerals.

Sounding 78, 10th August 1894, lat. 19° 33·3′ S., long. 156° 26·9′ E., 1568 fathoms.

Globigerina Ooze, fawn.

Calcium Carbonate (83·4), pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, otoliths and teeth of fishes, single Heteropod fragment seen ; coccoliths, rhabdoliths.

Residue (16·6%) brown.

Minerals [2], pumice, magnetite, glassy particles, palagonite, small rounded quartz grains covered with ologist.

Siliceous Organisms [2], Sponge spicules, Radiolaria, arenaceous Foraminifera, Diatoms.

Fine Washings [12·6], amorphous clayey matter and minute mineral particles.

Sounding 109, 15th August 1894, lat. 18° 53·5′ S., long. 157° 6·9′ E., 1570 fathoms.

The sounding tube brought up three characteristic spherical black manganese nodules, the largest of which is thus described by Mr. Teall of the Geological Survey :—"The largest nodule measures about three-quarters by half an inch. The crust of manganese oxide is about one-eighth of an inch in thickness. The nucleus is a sub-angular fragment of a light coloured augite-granophyre. Under the microscope the rock is seen to be composed of more or less idiomorphic crystals of plagioclase and grains of a green pyroxene in a micro-pegmatitic matrix of quartz and felspar. A few grains of iron-ore are also present. Similar rocks occur amongst the granophyres of the Inner Hebrides."

Sounding 101, 14th August 1894, lat. 18° 33·3′ S., long. 156° 39·5′ E., 1642 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (81·2%), pelagic and bottom-living Foraminifera, Echini spines, Ostracodes, teeth of fishes, fragments of Heteropods, coccoliths, rhabdoliths.

Residue (18·8%), brown.

Minerals [2%], pumice (two pieces about 3 mm. in diameter observed with projecting crystals of felspar, etc.), glassy particles, quartz (some small rounded grains covered with ologist), palagonite, manganese grains. Except the pumice, the mineral particles are nearly all less than 0·05 mm. in diameter.

Siliceous Organisms [4%], Sponge spicules, Radiolaria, Diatoms, fragments of arenaceous Foraminifera.

Fine Washings [12·8%], amorphous clayey matter and minute mineral particles.

Sounding 106, 14th August 1894, lat. 18° 49·5′ S., long. 157° 12·6′ E., 1645 fathoms.

The sounding tube brought up a piece of rock covered with manganese, which is thus described by Mr. Teall :—"Angular fragment of a mottled yellowish jasper coated with a thin crust of manganese oxide. The rock is formed of cryptocrystalline and microcrystalline quartz. The cryptocrystalline portions are stained yellow and occur in irregular patches ; the microcrystalline portions form veins and are comparatively free from colouring matter. Traces of the concentric deposition of silica may be seen, but re-crystallisation appears to have taken place."

Sounding 77, 9th August 1894, lat. 20° 10′ S., long. 156° 3·9′ E., 1740 fathoms.

Globigerina Ooze, fawn (creamy white when dry).

Calcium Carbonate (72·0%), pelagic and bottom-living Foraminifera, Echini spines, Ostracodes, teeth of fishes, one or two fragments of Pteropods and Heteropods, coccoliths, rhabdoliths.

Residue (28·0%), light brown.

Minerals [1%], pumice (one piece 4 mm. in diameter observed), magnetite glassy particles.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [25%], amorphous clayey matter with a few minute mineral particles.

Sounding 80, 11th August 1894, lat. 18° 35·1′ S., long. 157° 10·5′ E., 1758 fathoms.

Globigerina Ooze, fawn.

Calcium Carbonate (79·4%), pelagic and bottom-living Foraminifera, Echini spines, Ostracodes, teeth of fishes, single fragment of Pteropod seen, coccoliths, rhabdoliths.

Residue (20·6%), brown.

Minerals [2 %], pumice (one piece 4 mm. in diameter observed), volcanic glass, magnetite, quartz.

Siliceous Organisms [3 %], Sponge spicules, Radiolaria, fragments of arenaceous Foraminifera, Diatoms.

Fine Washings [15·6 %], amorphous clayey matter and minute mineral particles.

Sounding 83, 11th August 1894, lat. 18° 35·4′ S., long. 156° 59·4′ E., 1798 fathoms.

Globigerina Ooze, dirty white when dry, grey when wet; fine-grained.

Calcium Carbonate (84·5 %), pelagic and bottom-living Foraminifera (the shells are nearly all of small size, with a very large proportion of young ones, and many of them are coloured brown by manganese or with black spots), a very few Pteropod fragments, Ostracodes, Echini spines, otoliths and teeth of fishes, Polyzoa, coccoliths, rhabdoliths.

Residue (15·5%), chocolate colour.

Minerals [3 %], pumice, quartz (sometimes coated with ologist), manganese grains, palagonite, glassy particles; an angular crystal (quartz or felspar) 0·4 mm. in diameter was observed.

Siliceous Organisms [4%], Sponge spicules, brown casts.

Fine Washings [8·5 %], amorphous clayey matter with oxides of manganese and iron.

Sounding 126, 8th September 1894, lat. 17° 59′ 6″ S., long. 157° 30′ 25″ E., 1845 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (71·9 %), pelagic and bottom-living Foraminifera, teeth of fishes, single Pteropod fragment noticed, coccoliths, rhabdoliths.

Residue (28·1%), brown.

Minerals [3 %], principally pumice (one piece 6 mm. in diameter observed), volcanic glass, palagonite, olivine, quartz.

Siliceous Organisms [4 %], Sponge spicules, Radiolaria (including Challengeridæ), Diatoms, arenaceous Foraminifera, imperfect casts.

Fine Washings [21·1 %], amorphous clayey matter and minute mineral particles.

Sounding 125, 8th September 1894, lat. 18° 21′ 59″ S., long. 157° 58′ E., 1965 fathoms.

Globigerina Ooze, of a fawn colour.

Calcium Carbonate (73·6 %), pelagic and bottom-living Foraminifera, Echini spines, otoliths, single Pteropod fragment observed, coccoliths, rhabdoliths.

Residue (26·4%), brown.

Minerals [3 %], pumice (one fresh piece 2 mm. in diameter noticed, while another piece 4 mm. in diameter was much altered and fell to powder between the fingers), felspar, magnetite (one fragment 2 mm. in diameter), palagonite, quartz (sometimes covered with ologist).

Siliceous Organisms [4 %,] Sponge spicules, Radiolaria (including Challengeridæ), Diatoms, arenaceous Foraminifera.

Fine Washings [19·4 %], amorphous clayey matter and minute mineral particles.

THE NORWEGIAN POLAR EXPEDITION, 1893-96.[1]

HERE, in two well-printed and abundantly illustrated volumes, we have the story of the recent Polar Expedition fully and adequately set forth.[2] The work is admirably written, and without apparent effort conveys a convincing impression of the conditions that obtain in circumpolar regions. Dr. Nansen is not only a fearless and successful explorer, but he has the gracious gift of an excellent literary style. Nowhere in the literature of Arctic travel do we meet with more graphic description—more cunningly-worded delineations of all that is weird, awful, and beautiful in the realms of the great frost-king. The writer is saturated with the spirit of those regions, and the reader will be dull indeed who does not rise from the perusal of this work with a clear conception of the strange world through which the *Fram* drifted so successfully. And this conception is heightened by the numerous illustrations which exactly serve their purpose, and add greatly to the interest of the narrative. Successful in every respect, the Norwegian Expedition redounds to the credit of its originator and leader. As is well known, the plan of operations which Dr. Nansen propounded to the Christiania Geographical Society in 1890 has been exactly carried out. The conditions which he had foreseen and provided for were precisely those encountered by the Expedition, and the *Fram* pursued the very course which was expected of her—she traversed the Polar basin between Franz Josef Land and the Pole, and finally escaped from the ice to the west of Spitzbergen. Although Dr. Nansen had not undertaken to reach the Pole, but simply to traverse the Polar basin, yet when he found himself in lat. 86° 13·6′ he so far succumbed to the fascination which the "mathematical point" seems to have for all Arctic travellers, that, with his comrade Johansen, he made a great effort to reach it. If he did not succeed in doing so, he at least attained the highest latitude yet touched by man. Moreover, he has left us in no doubt that the Pole is situated not upon land but in the midst of an ice-laden sea, and that sooner or later some one following Nansen's lead will drift over it. It is extremely improbable, at all events, that any one will again attempt to reach the "mathematical point" by another route.

The route of advance most favoured by later expeditions has been that by Smith Sound. No doubt the difficulties to be encountered by that route were very great, but explorers were induced to follow it in the belief that it was necessary to keep close to a coast-line, and thus to ensure a reasonably safe line of retreat. Perhaps also they were tempted by the hope of being able to reach the "open Polar Sea," seen by Morton in 1856 (Kane's Expedition), and again by Captain Hall in 1871. The latter in the *Polaris* had reached the high latitude of 82° 16′ N. with so little difficulty, that many geographers were confident that a properly equipped expedition, following the same route, would have every chance of success. But the subsequent experience of the Nares' Expedition

[1] We are indebted to Messrs. A. Constable and Co. for the loan of the blocks to illustrate this review.

[2] *Farthest North*, by Dr. Fridtjof Nansen. Westminster: A. Constable and Co. 2 vols. 1897.

(1875-76) satisfied most authorities that the Pole was never likely to be conquered by the Smith Sound route. Their sledges had reached the highest latitude till then attained (83° 20′), and this record was slightly bettered by Lockwood, who, during the unfortunate Greeley Expedition (1881-84), reached 83° 24′. Since then no further attempt has been made in that direction.

Several explorers have tried to penetrate the secrets of the frozen north by way of the sea between Greenland and Spitzbergen. So far back as 1607, Hudson, in hopes of finding an open waterway to the Pacific, sailed along the east coast of Greenland, but was stopped by the ice in lat. 73° N. In later times the Koldewey Expedition (1869-70) followed the same route, and reached by sledges as far north as 77° N. It is not likely, however, that this route will ever be attempted again, for the Polar current which sweeps southward along the Greenland coast brings with it enormous ice-floes, against which progress is impossible.

A better route is that by the west of Spitzbergen, where, owing to the warm current from the south, the sea is kept open, and a ship can most readily make its way to a high latitude. It was here that Hudson succeeded in reaching 80° 23′ N., while it was north of Spitzbergen that Parry made his famous attempt in 1827. He reached 82° 45′ N., and thus broke the record for the time, but was forced to retreat when he discovered that the drift-ice over which he travelled was carrying him south more rapidly than he could advance.

The Austrian Expedition in the *Tegethoff*, under Weyprecht and Payer (1872-74), the object of which was to seek for a North-east Passage, was set fast in the ice off the north point of Novaya Zemlya, and, drifting northward, discovered Franz Josef Land—the highest latitude reached being 82° 5′ N.

Few have attempted to penetrate to the high north by Bering Strait —the most notable expedition following that route being De Long's in the *Jeannette*. De Long fixed on this route in the belief that a warm current ran north through Bering Strait and past the east coast of Wrangel Land. He thought that this current would open a way along that coast, possibly up to the Pole. His ship, however, was beset in the ice in 71° 35′ N., and drifted in a WNW. direction for nearly two years, when it foundered off the north of the New Siberia Islands, in lat. 77° 15′ and 154° 59′ E. long. Three years later a number of articles which had belonged to the *Jeannette* were found frozen in the drift-ice on the south-west coast of Greenland.

Possibly it was this evidence of a transpolar drift of floe-ice which first suggested to Nansen the possibility of traversing the Polar basin in that direction. All other routes to the high north were obviously blocked. Only in the cases of the *Tegethoff* and the *Jeannette* had any ice-bound ship drifted towards the north; all the others had been carried southwards by ice-laden currents. Nansen felt convinced that it was hopeless to fight against the forces of nature. But, if a transpolar drift really existed, then that might be utilised: instead of working against currents it was obviously the better plan to work with them. The drift of the *Jeannette* and her relics seemed to indicate the existence of a transpolar

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ICE-SMITHY, MAY 1895

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THE DRIFT-ICE IN SUMMER, 12th JULY 1894

current, and if so, then this was the route that promised the readiest access to the unknown north. There were a number of other facts, moreover, all of which pointed to the same conclusion. An Alaskan "throwing-stick" had been picked up on the coast at Godthaab; drift-wood of Siberian origin was met with on the same coast, and had been found floating in the sea off the east coast of Greenland. Nansen showed that this drift-wood could not have passed south of Franz Josef Land and Spitzbergen. He pointed especially to the fact that the *Jeannette* Expedition had frequently found Siberian drift-timber between the floes in the strong northerly current to the north of the New Siberian Islands, while similar drift-wood had been seen north of Spitzbergen in the powerful current against which Parry fought in vain. Nansen also recalled the fact that the flora of Greenland includes a number of Siberia species which could hardly have been introduced in any other way than by a current carrying seeds. He further cited his discovery of quantities of mud on the drift-ice between Iceland and Greenland. This mud, he thought, was most probably of Siberian origin, and Dr. Törnebohm showed that the inference was correct, for the mineralogical composition of the mud proved that it had come from Siberian rivers. Nor was this all, for Professor Cleve obtained from the ice-borne mud a number of diatoms of precisely the same species as Nordenskiöld had collected on an ice-floe off Cape Wankarem, near Bering Strait. Of the sixteen kinds common to the muds obtained from the ice-floes of Denmark Strait and off Cape Wankarem, twelve are peculiar to the Siberian coast, having been found nowhere else. So complete a resemblance between the diatomaceous floras on the ice-floes of North Siberia and Greenland led Cleve to conclude that an open communication must obtain between the seas east of Greenland and north of Asia.

Such were some of the chief data on which Nansen based his belief that an ice-laden current traverses the Polar area from east to west. The existence of an ocean-connection across the Polar area was not doubted by some experienced Arctic navigators, but they were of opinion that the drift was not at all likely to be in the direction Nansen supposed. On the other hand, some maintained that the chief danger to contend with would be land in every direction near the Pole. They thought that the *Jeannette* relics may have been drifted through narrow channels, but that a ship carried in the same direction might impinge upon the land, and be imprisoned for years. There were many also who were more than doubtful whether any ship, no matter how strongly constructed, could withstand the pressure of the ice-floes.

It is a great triumph for the Norwegian Expedition that Nansen's views, so clearly stated in his address to the Christiania Geographical Society, should have been so remarkably verified. The drift of the *Fram* was precisely in the direction which the leader of the expedition had anticipated. Moreover, the ship itself behaved just as had been expected by its designer, and made its perilous traverse in perfect safety. No body of Arctic explorers, indeed, ever passed so long a time in those high latitudes in such comfortable circumstances as fell to the lot of this carefully planned expedition.

The story of the *Fram's* adventurous journey must be read in Nansen's own pages. It would be superfluous to attempt a dry outline of it here. We cannot refrain, however, from a brief reference to the marvellous sledge journey performed by the leader and his trusty comrade, Johansen. When the news of the leader's arrival home reached this country, and it was known that he had left the *Fram* behind in the ice-pack, those who knew Dr. Nansen were quite sure that a satisfactory explanation would be forthcoming. His long experience of the *Fram's* solidity, and his confidence that it would reach the sea west of Spitzbergen in comfort and safety were, as we now see, fully justified. No one can read the account of life on board the *Fram* without feeling assured that the expedition in the absence of its leader was quite capable of looking after itself. Knowing all this, and being unwilling to miss an unique opportunity of increasing our knowledge of Polar regions, Nansen resolved on an adventurous sledge journey. As the risks involved were great he boldly resolved to share them. His story of that venture is one of the most interesting and thrilling narratives ever penned, and will long be cited as a perfect presentment of manly courage and decision, of indomitable resolution and endurance. A mere increase of our geographical knowledge is not all that we are indebted for to those gallant Norsemen.

The scientific results of the expedition have still to be worked out, and Dr. Nansen naturally makes only passing reference to them. No doubt we shall hear much ere long as to the magnetic, the hydrographical, and the meteorological observations carried on by the various members of the expedition, and the problems suggested will assuredly give rise to much interesting discussion. Meanwhile, the present beautiful volumes picture forth the conditions that obtain in the high north in a manner hitherto unsurpassed. The writer has not only an eye for the strange icy scenery through which he drifted—for the majestic aspect of sky and frozen ocean—but we seem to know the natives of those high latitudes—the birds, the walruses, and the bears—more intimately than before, for Nansen is above all a true naturalist. And some of the outstanding discoveries of the expedition must even now be exercising the minds of scientific men. The great depth attained by the Polar Sea has astonished not a few geographers, amongst whom there would seem to have been a somewhat general impression that only shallow seas need be looked for in the highest latitudes.[1] No great depths had been met with anywhere between the northern coasts of the continental area and Spitzbergen and Franz Josef Land. All these islands, however, are really portions of the continental plateau, as the character of their rocks sufficiently shows, and there was no reason for supposing that the deep depression lying between Spitzbergen and Greenland did not continue north through the Polar area. Certainly there are no geological nor palæontological data which demand for their explanation the existence of shallow water or dry land surrounding the Pole. That land-connection of some kind formerly

[1] Among those who held that a deep ocean existed towards the Pole was Dr. John Murray. This opinion he expressed in 1889, when Captain Hovgaard lectured before the Society. (See vol. vi. p. 39.)

obtained between North America and north-west Europe can hardly be doubted, but, as geologists have often indicated, the line of connection was most probably between south-east Greenland and the British area by way of Iceland and the Faeroes.

Again, certain writers, commenting upon the discovery of a deep Polar Sea, have remarked that this destroys all belief in the former existence of a Polar ice-cap. But that belief was never held at any time by more than one or two geologists, and has been exploded now for upwards of quarter of a century. It is matter of common knowledge that the glacial phenomena of Europe and North America have been produced by ice formed within those regions, and not by any ice-cap coming from the Pole.

But if the discovery of a deep Polar Sea does not call for any modification of geological opinion as to a former connection of north-west Europe and south-east Greenland, and if it leaves the accepted results of glacial investigation just where they were, nevertheless it furnishes much food for thought both to geologists and biologists. That the deep Polar basin should be occupied below depths of 100 to 500 fathoms with relatively warm water is a most suggestive fact. There is good reason to believe that in geologically recent times the Gulf-stream or Atlantic current flowed north in much larger volume than is now the case. And if, under existing conditions, the presence in high latitudes of so great a body of water above the freezing-point perceptibly influences the meteorological conditions, it is easy to see that with a more abundant influx of yet warmer water the climate of the high north must have been profoundly affected. The presence of a deep basin of warm water extending across the Polar area helps us to account for the remarkably genial climates which formerly reigned in Arctic lands. But these and other matters will doubtless be fully discussed when all the material brought home by the Norwegian Expedition has been digested and arranged.

Meanwhile, we recognise that the map of Franz Josef Land has been improved to some extent by Dr. Nansen. He found that the tracts actually passed over by Payer had been very correctly delineated. Indeed, Payer's observations, as recently worked out by Professor Copeland, are quite accurate as far as his actual route was concerned, some errors in his map being due to the draughtsman. But, as so often happens in those regions, his eye was deceived as to the appearance of land at a distance. We gather, also, from Nansen's narrative, that the coast of Siberia, as set down upon the maps, is far from being correct. He experienced great difficulty in locating the various points he approached or landed upon. We get glimpses, also, of geological conditions which may lead to very considerable revision of the notions now prevalent as to the state of northern Siberia during the Ice Age. Clays crowded with and dotted over by large erratics, probably derived from the Siberian uplands, seem to indicate that the low grounds bordering on the Arctic Ocean were largely submerged, while glaciers, or a continuous ice-sheet coming from the south, calved their icebergs, and dropped their stony burdens over the drowned areas.

Those who are interested in Arctic research need no inducement to

read Nansen's work, but we can cordially recommend its perusal to others. They will be charmed and thrilled by this narrative of one of the most successful expeditions that ever left the shores of a civilised country.

J. GEIKIE.

WALTER SCOTT DALGLEISH, M.A., LL.D.

THE SCOTTISH GEOGRAPHICAL SOCIETY has lost a valuable friend in the unexpected death of Dr. Scott Dalgleish, which took place on Monday, February 13th, after a very short illness. He had not been in good health for some time, but attended a meeting at the Society's Rooms on the previous Wednesday, and was active in assisting in the arrangements for the reception of Dr. Nansen. That same evening an attack of influenza prostrated him, and, followed by congestion of the lungs, ended fatally in four days.

Dr. Dalgleish was educated at Edinburgh University, of which he was an M.A.; and the University of St. Andrews, a few years ago, conferred on him the degree of LL.D. In early life he conducted a private school, but for many years he had been principal editor in the publishing house of Messrs. T. Nelson and Sons. In the many educational works with which he was connected, he greatly contributed towards raising our school-books to their present state of efficiency. In addition to his special work, Dr. Dalgleish had many literary interests. He frequently contributed to the leading Reviews, and for many years was principal *Times* correspondent in Scotland. He was an active worker in all educational matters, and, as a member of the General Council of the University of Edinburgh, took a leading part in the deliberations of that body, and in the representations it made to the University Council—notably in connection with the Ordinances of the University Commissioners. He was also prominent in organising the University Local Examinations in Scotland, which, before the leaving certificate was instituted, provided a stimulus to effort among the Scottish schools, and was a test of their efficiency.

When the Scottish Geographical Society was formed in 1884, Dr. Dalgleish was among its early promoters, and worked zealously on its behalf. He served on the Council from the beginning, and as Chairman of the Education Committee spared no effort in promoting its special objects. Ten days before his death he presided at a meeting for the formation of a Scottish Branch of the Geographical Association for the promotion of geographical teaching in schools. His untimely loss will be much felt by the Society, for, whether in acting on its committees, in contributing to its magazine, in presiding at its meetings, or in any other way, he was always cordial and ready to further its interests.

J. G. B.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Nansen Lectures.

On the evening of February 12th, Dr. Nansen was enthusiastically welcomed in the Synod Hall, Edinburgh, by a large audience. In the unavoidable absence of the President of the Society, Lord Lothian, the Chair was taken by the Marquis of Tweeddale, who introduced Dr. Nansen in a short speech. The explorer then briefly explained the plan of his late expedition and the reasons which guided him in forming it. He then gave an interesting sketch of the voyage of the *Fram* and of his sledge journey, in company of Lieutenant Johansen, to Franz Josef Land, illustrated by many excellent slides. Lord Pearson, having proposed a vote of thanks to Dr. Nansen, which was heartily responded to by the audience, the Chairman presented to Dr. Nansen the Gold Medal of the Society, and intimated to him that he had been made an Honorary Member of the Society.

Dr. Nansen lectured at the St. Andrew's Hall in Glasgow on February 15th. Sir W. Renny Watson presided, and Lord Kelvin proposed a vote of thanks which was seconded by Lord Provost Richmond.

On the 17th a meeting was held in the Kinnaird Hall at Dundee, at which Mr. I. J. Weinberg presided. After Dr. Nansen had described his wanderings in the Arctic regions he was awarded a hearty vote of thanks on the motion of the Chairman, seconded by Lord Provost M'Grady. Dr. Nansen, in returning thanks, remarked how much Arctic exploration had been advanced by whalers, many of whom had sailed from Dundee, and that it was owing to their experience he was able to build a vessel capable of standing all the trials of navigation among the ice.

Professor Dove Wilson presided at a meeting in the Mitchell Hall, Aberdeen, on the evening of February 18th. Lord Provost Mearns proposed a vote of thanks to Dr. Nansen.

Everywhere Dr. Nansen received the most hearty reception, and the halls were crowded with eager audiences.

The Banquet.

About 240 members of the Society and their guests met at the Waterloo Rooms, Edinburgh, on February 13th. The Marquis of Tweeddale presided, and gave the toasts of the Queen and the Royal family, which were duly honoured. He also proposed the "Army, Navy, and Reserve Forces," which was responded to by Commander Stokes, R.N., and General Sir R. Murdoch Smith.

Then Professor Geikie rose to propose the health of the guest of the evening. He said he esteemed it a high honour to have this toast put into his hands—the health of their guest, the gallant and distinguished Dr. Nansen. They were all delighted to welcome him back again in their midst in the full possession of his vigorous vitality. All of them would remember that when the *Fram* was about to set out upon her remarkable voyage many misgivings and doubts were expressed, not only by the man in the street, but by some of our wisest and sagest geographers, hydrographers, and other men of science, and even by experienced Arctic explorers; and no doubt these misgivings were shared by a very large number of people throughout the country. Dr. Nansen was looked upon as leading a kind of forlorn hope, and people shook their heads and looked very

grave. But Professor Geikie could vouch for some who did not share these forebodings. They had, first, a personal knowledge of Dr. Nansen, and they knew him, not as a rash enthusiast, but as a clear-headed, shrewd observer; a cautious, careful scientific investigator; a man with large experience of Arctic travel; a man, in short, not at all likely to lose his head. They remembered, also, that Dr. Nansen had crossed Greenland, and that meant a very great deal indeed. Dr. Nansen was not only gifted with fine enthusiasm, magnificent physique, great pluck and endurance, but was also largely endowed with the scientific imagination, and he did not believe that their guest would ever have crossed Greenland, or ever attempted to traverse the Polar basin, unless he had been so endowed. What was meant by scientific imagination? Simply the power of seeing things clearly as they were, and of clearly apprehending and comprehending what they meant. They could see the application of that in everything connected with his traverse of Greenland. He had thought it all out, put every little fact together, and come to a certain conclusion. Professor Geikie had the pleasure of conversing with him shortly before he passed on to Greenland, and in talking to him found that he had formed a very clear view indeed. He knew what to expect. He knew that the greatest difficulty he probably would encounter was among the free ice before he landed in Greenland, and he knew that when he landed in Greenland all would be comparatively plain sailing. There would be hardships, no doubt, but he firmly believed that he would get safely to the other side, and made all due preparations for every eventuality, and they all knew how he succeeded. In the case of this last memorable expedition of the *Fram*, he went through the same process of reasoning. By an exhaustive series of observations and study, he collected all the data bearing upon the drift of Arctic ice, and, thinking over the bearing of these facts, which, of course, were known to geographers, and about which many geographers had speculated, he saw quite clearly that they could have but one meaning, namely—that an Arctic current traversed the Polar basin from east to west. The facts, as he said, had been known to many others, but Dr. Nansen was the first actually to see them with the scientific eye, and to deal with them with the scientific imagination. And having realised their meaning, he felt perfectly certain—so certain and so sure that, Dr. Geikie believed, had Dr. Nansen been a betting man, he would have bet any amount on the result of his proposed expedition. In all this they had clear indication of the kind of man their guest was. Having once formulated a theory and come to the conclusion that an Arctic current swept across the Polar basin, Dr. Nansen next set about the building of a suitable ship. Dr. Nansen was the designer of the *Fram*. He saw, that in order to secure the secret of the North, he must use the forces of nature and not fight against them, as all his predecessors had been trying to do. Dr. Nansen had got upon the ice and had allowed the ice to carry him. But of course the difficulty was the ice crush, and they all knew how the *Fram* triumphantly justified its inventor's expectation. It would be absurd on his part to attempt to go through the history of the *Fram* expedition, but he would like simply to point out some of the scientific results of that expedition, very shortly, because they had not been worked out yet, and would not be for some considerable time. There were certain salient facts, however, to which he might refer. There was first Nansen's discovery of the trans-Polar current. Then there was the demonstration of a deep oceanic basin in the Polar region—a very remarkable fact. There was also the discovery of the very interesting and remarkable fact that beneath so many fathoms from the surface they had water above freezing-point—relatively warm water below, with cold water above. That seemed a very strange arrangement; and one of the results he hoped of the expedition would be the working out of the meaning of that particular fact. Thereby they would gain

THE SOCIETY'S GOLD MEDAL, PRESENTED TO DR. NANSEN ON FEB. 12TH.

more information and knowledge of the mechanism of the oceanic currents. The presence of this great body of warm water undoubtedly must have very considerable meteorological effects. They knew that on the *Fram* constant daily weather observations were made throughout the whole of its adventurous voyage; and Dr. Nansen himself, during his memorable journey upon the ice, also made daily weather observations. Then, again, they had the observations made by Jackson in Franz Josef Land, and of Ekroll in East Spitzbergen, so that meteorologists had a large series to digest. Without doubt, these observations, when they were thoroughly digested, would throw a considerable light upon the causes of the climate of North-Western Europe. At all events, it would be extremely interesting to know what kind of weather they had in North-West Europe at the time the *Fram* was drifting on its adventurous journey. Passing from these scientific observations, and returning once more to the *Fram* itself, he said they all knew that travel in the Polar regions must of necessity entail a certain amount of peril, privation, and endurance. The history of Arctic travel had shown how many brave and gallant men had gone to these regions and never returned—men who had been lost fighting against the great frost-king, but unable to overcome him. When one looked round about nowadays, and saw the great enthusiasm with which their guest had been received in this country, one was sometimes inclined to ask what was the cause of that great enthusiasm. No doubt every one was delighted to see Dr. Nansen and his comrades back after their strange adventures and their life of peril. Relief, then, was one reason why they were enthusiastic. But there was yet another reason. They were delighted that the expedition had been successful. They were also filled with admiration at the pluck and endurance of all the members of the expedition. He thought that there was, perhaps, something more than that. Although every true-born Briton must always have an admiration for manliness, pluck, and endurance, yet their admiration and sympathy were increased when they recognised in Dr. Nansen's remarkable expedition the exact fulfilment of his own predictions. Dr. Nansen had worked out the whole scheme scientifically. Owing to his large gift of scientific imagination, he could see what the exact result would be. He knew perfectly well where he was going, what he was doing. He formulated his theory, and, as they knew, he had now demonstrated its truth. He (Prof. Geikie) thought it was the most triumphant success of Dr. Nansen's scientific theory—or speculation, if they chose to call it so—which pleased him (Prof. Geikie) most. There was, perhaps, no part of the story of Dr. Nansen's expedition that touched the imagination more than that of his and Johansen's sledge journey after they left the *Fram*. Let them think of it. When Nansen and Johansen left the *Fram* they knew perfectly well that they carried their lives in their hands. Nansen, with his splendid self-reliance and self-confidence, no doubt deep in his inner soul felt that somehow or other he would turn up trumps at the end. He had not the pleasure of knowing Johansen, but he must be a splendid fellow. Johansen had infinite faith in his chief, and so those two gallant men went on their way; and they had heard on the previous night the thrilling account given by the leader of the expedition—told in his own inimitable way, full of touches of humour—his delightful humour being one of the many charms of a very charming personality. Nine months spent in a hut, with the temperature forty degrees below zero, was not a comfortable position. Nansen told them, perhaps with a slight poetical licence, that for twenty hours out of the twenty-four he slept. It required a good deal of pluck to sleep so long as that under such circumstances. But, fortunately, everything turned out well in the end. He demonstrated the truth of his theories, and he came back and found the *Fram*, after he had arrived, with its crew perfectly well. It seemed like a fairy tale. He (Prof. Geikie) thought they would all agree

that Norway—"Gamle Norge"—had good reason to be proud of her sons. That story of the *Fram* would live in the history of Arctic discovery—would live to stir the blood and quicken the pulse of all good-hearted men in all time coming. They were proud that night to receive as their guest the far-seeing, clear-sighted scientific man, the brave explorer, the generous and devoted leader of an expedition, in their gallant guest, Dr. Nansen.

In replying to the above, Dr. Nansen spoke of the generosity of the Norwegians in supplying him with funds for his expedition in spite of their doubts as to the results. He also spoke in high terms of his comrades, their thorough trust in their leader, their readiness to carry out whatever he planned, and their unfailing cheerfulness under all circumstances, and acknowledged his indebtedness to Mr. Colin Archer, a Scotsman, who built the *Fram*. Dr. Nansen's health was drunk with the usual honours, and cheers were given for Mrs. Nansen, who, with some lady members of the Society, watched the proceedings from the gallery.

Sheriff Smith proposed, in an eloquent speech, the toast of "Other Geographical Societies and Polar Exploration," coupling with it the name of Dr. John Murray. Dr. Murray replied as follows :—

"I suppose my name has been associated with this toast because I am a Fellow of a large number of Geographical Societies, and because I am one of the relatively few living men who have crossed both the Arctic and Antarctic Circles. In any case I consider it a high honour to be asked to reply not only for geographers in general, but also for the two ends of the earth. The subject might be treated with abundant illustration did time permit.

"Last evening I overheard a gentleman say he could see no use and no good in these Arctic expeditions; and one often hears similar sentiments from the philistine in the railway carriage, or from the old lady at afternoon teas This, to my mind, is a survival from a barbarous mode of thinking quite out of keeping with our advanced civilisation; men holding such views will soon be as extinct as the Apteryx and the Great Auk. I hold that anything which adds beauty and variety to human life is useful. I cannot say that there was much direct utility in the *Challenger* Expedition, and yet that work is acknowledged to be the most splendid and lasting monument erected by the British people during the reign of Victoria.

"Nansen sailed north to cross the Polar basin, and he has done so successfully: it was not an essential part of his scheme to reach that mathematical point called the Pole. He has demonstrated that men can live for three years within the Arctic regions in good fellowship and without the plague of scurvy. He has shown that there is a deep sea at the Pole, and when we are in possession of all his observations we shall be able, I have little doubt, to sketch out the main features of the North Polar region. In the North we now know that there is a deep basin almost completely surrounded by continental land; at the South Pole, on the other hand, there is just the reverse—a mass of continental land surrounded by the encircling sea.

"I regret that the *Fram* did not float right across the Pole, for then all possible imitators of Nansen's voyage would, in all probability, direct their energies to the Antarctic, where, in the future, great discoveries will reward adventurous spirits. Observations of all kinds are especially needed in the south for comparison with the more numerous ones in the north. In the continental land surrounding the north Polar basin we have fossil rocks which show that at one time coral reefs and extensive forests flourished within the Arctic circle. We wish to know if a similar state of matters prevailed within the Antarctic in past ages. We wish to know if the continental land of the Antarctic lies buried

beneath twenty-five miles of ice, as some scientific men believe, or, as I think more probable, beneath only some 2000 feet of land ice. We wish to know how this ice-sheet moves over the land. We wish to know whether or not a great anti-cyclonic area covers the South Pole corresponding to the low barometric region over the surrounding Southern Ocean. We want observations around the South Magnetic Pole. We wish to know the circulation of the ocean waters around Antarctica at different seasons of the year. We wish a fuller knowledge of the marine organisms of the Antarctic regions for comparison with those in the Arctic. To emphasise the interest of these questions, I may state that I have recently drawn up a list of over two hundred marine species which are common to both the Arctic and Antarctic regions, but so far as we at present know these wholly disappear from the shallow and deep water of the intervening Tropics. So that we have this curious anomaly : the marine fauna and flora of the Arctic and Antarctic —although separated from each other as widely as the Poles—are yet more closely allied to each other than to any other fauna and flora on the surface of the earth. Who will deny the interest attached to such problems? As a step towards their solution we wish a British Antarctic Naval Expedition to sound out the great Southern Ocean, to lay down the contour lines of the Antarctic continent, and to carry out researches in various directions. Were a party of men, like Nansen's, landed at Cape Adare, in Victoria Land, they would probably travel to the Pole, and return in a single season. To comprehend the existing distribution of phenomena on the surface of our globe we must know the past history of the Polar regions. The possession of such information might give a great impetus to the intellectual development of future generations.

"It may be maintained with much justice that all great intellectual movements in the past have been preceded by some great geographical discovery. When, four centuries before our era, the Greeks under Pytheas burst through the Pillars of Hercules and reached the shores of these islands, they were greatly astonished at the high tides of the outer sea, and they carried back with them some knowledge of a northern land—*Ultima Thule*—where at midsummer the day had a length of twenty-four hours. These new ideas had a striking effect on the Greek mind, and led, perhaps, more than anything else to the foundation of scientific geography. When Hippalus, about the beginning of our era, abandoned coast routes and, trusting his ship to the monsoon wind, reached India by a direct course, and returned with the opposite monsoon, a fuller knowledge of the far east was ushered in, and led after a long time to the travels of Marco Polo. It was to reach the rich countries in the far east that Columbus set sail to the west, and, crossing the Atlantic, discovered America. Then followed in quick succession the rounding of the Cape of Good Hope by Da Gama, and the circumnavigation of the world by Magellan. It is impossible to exaggerate the effect of these great events on the human mind ; the fiery zone of the ancients had been crossed ; the doctrine of the Antipodes was no longer a scientific theory, but an ascertained fact. The world had been sailed around with the loss of a day ; it was now known to be swung in space, supported by some unseen power. You can trace the influence of these great ideas throughout the literature of the whole Elizabethan period : Shakespeare had the image of the great floating globe continually before him ; his spirit seemed

> '. . . blown with restless violence round about
> The pendent world.'

All the marvellous progress of science and civilisation during the past 400 years can be traced back to the great geographical discoveries in the thirty years between 1492 and 1522.

"It may well be that in Nansen we have the Prince Henry the Navigator, or the Columbus of Polar exploration: his recent voyage may lead directly to a very complete exploration of the two Polar areas. What is it, I ask, that filled the Albert Hall in London, the other evening, with the most magnificent audience I ever beheld? What filled our own largest hall to overflowing last night, and what has brought so many of you here this evening? Many people are, of course, interested in the narrative of the voyage, and the scientific observations, but there are other reasons. Not all the panegyrics of the most eloquent tongue can equal the deep-rooted admiration which we Britons—we Scotsmen—feel for a success won by a rare combination of courage, forethought, knowledge, and devotion. This is a tribute we should pay to the triumphant manhood of any nationality. Something still deeper, however, can, I believe, be traced in the admiration that now finds expression. We recognise in the highest types of our race that the objects uppermost in consciousness are even more or less immaterial in their nature. 'Tis long since we were told that man did not live by bread alone. In the course of history, hundreds of men have thrown off this earthly coil as so much worthless dross, in obedience to the demands of some spiritual truth. As with the religious spirit, so is it with the artistic: men make great sacrifices to satisfy the ever renewed craving to create the beautiful in form, in colour, and in sound. As it is with the religious and artistic spirit, so is it with the scientific spirit. Not all the frost and snow within the 'thrilling regions of thick-ribbed ice' can quench the desire to find out the secrets of nature.

"During the Ice Age our ancestors—erect on two legs—roamed along the shores of this country in search of food, living a squalid existence; and perhaps the only trace of intellectual life left behind them is a rude outline of their prey traced with a piece of flint upon a reindeer antler. Compare these ancient savages with the so-called modern savages—Nansen and Johansen—trudging over Arctic floes, burdened with scientific instruments for observation, burdened with scientific theories to be tested, and with all the purely animal desires reduced to a minimum. Make this comparison and you may form some idea of how far humanity has travelled in the interval between the Ice Age and the present time, you may catch some glimpse of the destiny of our race. In the one case the intellectual life appears as a mere appendage of the body; in the other, the body becomes but the vehicle of the soul.

"We must know all about the past history of this earth of ours. Modern science shows that the outcome of all the struggle and death in bygone ages has been the creation of man. Warfare and luxurious living may produce retrogression, but in the long-run nothing can stop the onward march of the human intellect. We have already determined to a large extent what plants and animals shall live about us on the surface of the land, and we shall one day determine what fishes shall live in the sea. Not the evolution of new species but the progress of man and of civilisation is to be the future course of events on this planet.

"All honour to the Norwegians! The only real advance in Antarctic exploration since the time of James Ross has been made by two little Norwegian whalers, the *Jason* and the *Antarctic*, and then we have this splendid voyage of the Norwegians in the *Fram* across the frozen Arctic sea. In the Antarctic lies the only great piece of maritime exploration still to be accomplished on the face of our globe. Will our great country take no part in this work? With Nansen representing Arctic ice seated on one side of him, and my enthusiastic self representing the Antarctic ice-barrier seated on the other side of him, Mr. Goschen must have had a very hot time of it the other evening. It is urged that the political conditions and the state of the navy are very different now from what they were twenty-

five years ago when the *Challenger* Expedition was sent out by this country. Officers, it would seem, cannot now be spared for Antarctic exploration. This may well be the case with the present political outlook, for those at the head of affairs must know well the demand on our navy, and we trust our legislators. But geographers and scientific men must take care lest the higher life of the nation should be completely smothered beneath our wealth and our armaments.

"I believe the people of this country are interested in every increase of natural knowledge. What is the low wail that we hear from afar, for fewer hours of labour, but a demand from the masses to take some part in the intellectual pleasures which it is the business of Geographical Societies to foster? The scientific public desires an Antarctic Expedition. The navy men wish for an opportunity to carry out the work. I believe such an expedition would be popular with the mass of the people. If Government cannot undertake the work, we must appeal to private enterprise and liberality. Perhaps a great international expedition might be organised.

"Scientific voyages commenced with James Cook more than a century ago, and it has been the custom of this country since then to send out such expeditions about every quarter of a century. That time has elapsed since the *Challenger* Expedition. Let us hope this excellent tradition of our country may not be hastily departed from.

"Nansen is no stranger in Edinburgh. He was here more than ten years ago inquiring about Antarctic research. We entertained the members of his Greenland expedition here on the eve of their departure. We congratulated him here at a banquet on his return, and now we congratulate him on the success of his recent successful voyage across the frozen Arctic Sea. Some day we may possibly entertain him on his return from the South Pole. We thank him for the light he has thrown on Polar problems; we are on the tip-toe of expectation as to the next development. We see hope and promise in the immediate future.

'There 's a fount about to stream,
There 's a light about to beam,
There 's a warmth about to glow,
There 's a flower about to blow,
There 's a midnight blackness changing into grey—
Men of thought and men of action,
Clear the way.

Aid the dawning, tongue and pen;
Aid it, hopes of honest men;
Aid it paper, aid it type;
Aid it, for the hour is ripe;
And our earnest must not slacken into play—
Men of thought and men of action,
Clear the way.'"

Ordinary Meeting in February.

On February 25th Mr. L. B. Clarence, late a Judge in the Ceylon Supreme Court, delivered in Edinburgh a lecture on the island. Colonel Sconce presided.

Lectures in March.

Colonel Sir C. E. Howard Vincent, M.P., will address the Society in Edinburgh on "The British in South America," on March 11th.

On the 25th of the month Dr. Robert Bell, of the Canadian Geological Survey, will deliver a lecture in the Society's Hall on the Trees of the Dominion.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Hakluyt Society held its fiftieth anniversary in the map-room of the Royal Geographical Society in December last. The President of the Society, Sir Clements Markham, delivered an address, in which he sketched the life and work of Richard Hakluyt. Born in Herfordshire in 1553, Hakluyt spent six years, 1564 to 1570, at Westminster school, then under the management of Dr. Gabriel Goodman, where many boys who afterwards became celebrated were at that time receiving their education. It was during his school days that an incident occurred which determined the bent of his mind for the rest of his life. He paid a visit to his cousin and namesake in the Middle Temple, and there found some books on cosmography and a map of the world, lying on his cousin's table. His cousin answered his eager questions, and ended by giving him a regular lecture on the parts of the world, their physical features, natural products, etc. This discourse made a deep impression on Hakluyt's mind, and he then resolved to pursue the study of geography. At Oxford, to which University he went in 1570, he did not neglect his regular work, though still enthusiastic on the subject of geography, and took his degree in due course ; but as soon as he had leisure, he searched out all the narratives of travel he could find, in print or in manuscript, and mastered six foreign languages that he might be able to read them.

He soon found that there was much ignorance among British seamen of the scientific principles of navigation, and his first public service was the delivery of lectures on the use and construction of maps, spheres, and nautical instruments. He also constantly urged on those in authority the importance of establishing a permanent lectureship "as a means of breeding up skilful seamen and mariners in this realm" ; but in vain.

Another want he set himself to supply was that of a record of voyages and travels. Richard Eden had made a collection, but most of the English voyages of the previous hundred years were almost entirely forgotten ; even of the voyages of the Cabots to America there was neither map nor narrative accessible. Hakluyt's first work was the *Divers Voyages touching the Discoverie of America*, published in 1582, in which he gathered together the fullest particulars then known, and by which he gave the first impetus to the colonisation of the east coast of North America.

Having taken orders, Hakluyt went to Paris as chaplain to the English Embassy, and during the five years he remained there, 1583 to 1588, he worked assiduously at the main object of his life. In 1590 he was appointed to the rectory of Wetheringsett in Suffolk, and he married in 1594. Several valuable books were published under his auspices, and in 1589 he brought out his own *Principal Navigations* in a folio volume ; but it was not till 1598 that the first volume of his more complete work first saw the light, the other two appearing in the two succeeding years. He spared no pains and trouble to render this as complete as possible, and he rode two hundred miles to have an interview with the last survivor of Hore's expedition to America in 1536. When he died as Archdeacon of Westminster, in 1616, at the age of sixty-four, he left behind him a large collection of material, which was published by the Rev. Samuel Purchas under the title *Hakluytus Posthumous ; or Purchas, his Pilgrimes.*

In 1846 a meeting of distinguished men was held in the London Library, with

Sir Roderick Murchison in the chair, when it was resolved to form a society, to be called the Hakluyt Society, for the purpose of printing and distributing among its members narratives of voyages and travels from an early period down to the circumnavigation of Dampier. The benefit conferred on students of historical geography by the publication of these volumes, now more than ninety in number, need hardly be insisted on.—*Geographical Journal*, Feb.

The Earthquake of Dec. 17th.—A few notes on this earthquake are published in Symons's *Monthly Meteorological Magazine* for January. The shock was felt at places as far apart as Tavistock and Yarmouth; Weymouth and Hartlepool (or, perhaps, Malton); Reigate and Beaumaris. The district affected was nearly 350 miles in maximum diameter. Nearly in the centre of this lies an elliptical area, extending for about 130 miles, from the neighbourhood of Tortworth in Gloucestershire to Manchester, with a maximum breadth of forty near the latitude of Birmingham, within which structural damage was produced. This area is nearly 4000 square miles, but the chief damage occurred in the southern portion, in parts of Hereford, Gloucester, and Worcester. The late shock seems to form one of a series which can be traced for six hundred years. The earthquakes recorded occurred in the years 1248, 1574, 1705, 1863, 1868, 1888, 1892, and 1893. It is curious to note that all these shocks had a similar extension. In 1574 the shock was recorded in every place where that of 1896 was felt, and at no place outside the 1896 area; and the areas of the earthquakes of 1863, 1868, and 1896 are also very nearly coincident. Of all the shocks that have occurred in the district affected, that of 1248 seems to have been the most violent, and the next worst was that of last year. The pecuniary loss resulting from the Essex shock of 1884 was much greater, but it was spread over only a tenth of the area, namely, 400 square miles.

The Climate of the Brocken.—A year's records of the observatory of the Brocken (3743 feet high), which, as announced in these pages, was established in 1895, are now complete. The mean temperature for the twelve months, October 1895 to September 1896, was 35·4°, or about 0·9° below the average obtained from the former imperfect records of 1836 to 1867. The coldest month was December 1895, with a temperature of 22·5°, or 2·7° below the average, while February 1896 was normal with 22·8°. The warmest month, July, had the average temperature of 51·1°, while the August mean was only 46°, or 4·5° below the long-period average. The means for the seasons were: winter, 23°; spring, 32·1°; summer, 49·3°; autumn, 36·7°. The absolute minimum (February) was strikingly high, being 2·1°, while, on the other hand, the maximum in July, 74·1°, corresponded to the elevation. The fall of temperature per 100 feet between the low-level station in the Klausthal (1942 feet) and the top of the Brocken, was on the average ·35°, being a little less than the previous estimate. It was least, ·17°, in January, and greatest, ·43°, in April and May. The rainiest months were October with 7·95 inches, March with 9·29, June with 8·9, and August with 11·14. The total for the year was 76·14, being nearly twelve inches or about eighteen per cent. above the normal. There were 224 days with rain, 188 were very dull, and only 34 were bright.—*Geogr. Zeitschrift*, Jahrg. iii. Heft 1.

A Canal Project in Switzerland.—A scheme for opening out a waterway between the North Sea and the Lake of Constance is now much discussed in Switzerland, and especially in the canton of Thurgau. The Kleiner Laufen, the rapids of the Rhine at Laufenburg, will be passed either by locks in the bed of the river or by a channel carried along the north side of the town, while the Grosser Laufen, the

falls of the Rhine at Schaffhausen, will be avoided altogether, and a canal will be constructed along the bed of the Thur, which enters the Lake of Constance at Romanshorn. In order to obtain a depth of water nowhere less than five or five and a half feet, and a breadth sufficient to allow two vessels to pass each other, the beds of both rivers must be deepened and widened considerably. It will also be necessary to construct sluices to carry the canal up to the summit of the watershed at Sulgen, 164 feet above the Lake of Constance, and also to collect water from the headwaters of the Thur, and bring it down to Sulgen by a tunnel nearly two miles long. It is also proposed to reach the Lake of Zurich by the Limmat, Lucerne and its lake by the Reuss, Bern and the Lake of Thun by the Aar, and finally the Lakes of Neuchâtel and Bienne by the Zihl; hence a connection is proposed with Geneva by a canal connecting the Thièle and Vernoge. As a further expansion of the canal system, a connection with the Mediterranean by the Rhone is contemplated, and between the Lake of Constance and the Black Sea through the Danube. To accomplish the former work it would only be necessary to render the Rhone navigable for the short stretch of the Perte du Rhône, while towards the Danube a low narrow moraine has to be crossed between the Schussen and the Riss.—*Geogr. Zeitschrift*, Jahrg. iii. Heft 1.

The Lago d'Orta.—Dr. Giovanni de Agostini of Florence has published a monograph on this lake, accompanied by three maps and sections. The lake lies almost entirely in the Novara District, and is the most eastern of Italian lakes on the Alpine slope. It communicates with the Lago Maggiore by an emissary, named Nigoglia, through the Strona and the Toce, the last being a feeder of Lago Maggiore. The length of the Lago d'Orta along its central line is 8·3 miles, and in a straight line 7·7 miles. Its breadth varies from 550 to 8200 yards; its perimeter is 20·8 miles, and its area, including the small island of San Giulio, 7 square miles. A subaqueous ridge, from the point of Crabia to Ronco, divides the lake into two basins, of which the northern is the deeper, with a maximum of 469 feet. As the average altitude of the surface is 951 feet, the lowest point of the lake is situated at 482 feet above sea-level. The Lago d'Orta is the second of the great lakes as regards the elevation both of its surface and of its lowest point, the surface of the lake of Idro being 1207 feet, and its bottom descending to 807 feet above sea-level. Only in these two lakes is the bottom wholly above sea-level.

The drainage area of the lake is 39⅓ square miles, or more than five and a half times that of the lake itself. By artificial means the outflow of the water has been regulated, and great variations in the level have been prevented. Dr. de Agostini shows from the geological history of the neighbourhood and the relief of the basin that the lake is of glacial origin. As regards temperature, the Lago d'Orta belongs to the tropical class of Forel, the minimum temperature of the bottom always exceeding 4° C. (= 39·2° F.); on February 9th and 19th, 1895, it was 40·6° F. Its *Sprungschicht*, both in spring and autumn, lies from 33 to 66 feet below the surface. Its transparency affords another proof that it is a function of the temperature. The colour of the water approaches to the blue of Forel's scale, that is, the natural colour of pure water.—*Boll. della Soc. Geogr. Italiana*, vol. x. Fasc. 2.

Bulgaria.—Prof. Jovan Cvijič has published a work in the Servian language on the Rilodagh, the lofty mountain range in the south of Bulgaria. It is divided into two sections by the valleys of the rivers Lewa and Ril, the north-western being lower than the south-eastern. The latter is composed of four main ridges built up of crystalline schists and granites, while the former has thirteen. The

rivers Marica, Mesta, the headwaters of the Isker, Crmena, and Ril all flow out of a series of lakes arranged one above another. Prof. Cvijič examined twenty-six lakes, noting their dimensions, elevations, temperature, colour, and composition of the bottom. The Ril is a mountain mass with permanent snowfields, the lowest of which descends to 6936 feet above sea-level. The average height of the snow-line is 8020 feet. Unmistakable signs of glacial action are to be seen near the lake Ejidola, and in the valley of the Upper Lewa.—*Globus*, Bd. lxxi. No. 6.

AFRICA.

Obock.—The French settlement on the Gulf of Aden, on which some information was given in vol. x. p. 489, is described in greater detail in the *Bull. de la Soc. de Geogr. Comm. du Havre*, 3me trim. 1896. The Gulf of Tadjourah runs inland for a distance of forty-five miles, from the Ras Bir to the entrance of the Ghubet-Kharab, and its opening, from Ras Bir to Djibuti, measures twenty-seven miles ; the total length of its shore is about ninety nautical miles. Opposite the entrance are the Musha isles, which also belong to France ; the group consists of three islands and five coral islets, and rises only some thirty feet above sea-level. The coast, formed by a cliff of madrepore rising about 100 feet high, does not present an attractive appearance from the sea. Behind the cliff a monotonous plain extends to the mountains in the interior, twelve to eighteen miles distant, which have a mean elevation of 2300 to 2600 feet and culminate in Jebel Guda, 5459 feet high. All the mountains are covered with dense forest, and the high plateaus of Guda are pasture lands with a temperate climate. Hither the natives of Tadjourah repair in May when the hot season commences.

At the bottom of the Gulf is a curious bay known as Ghubet-Kharab. It is an elliptical crater with a longer axis, from east-south-east to west-north-west, measuring thirteen and a half miles, and a shorter axis of half that length. Depths have been sounded of 160 to 210 fathoms. On almost all sides this basin is enclosed by cliffs of volcanic origin, at the foot of which the water is some thirty feet deep. The Ghubet is connected with the Gulf of Tadjourah by a narrow channel only 800 yards wide, which is divided into two by an island called by the natives the *Bab*, or gate. The passage on the south side, 400 yards broad, is navigable only by vessels drawing less than six and a half feet of water, while the other, 170 yards across, has depths of 90 to 115 feet. The tide rushes through these channels with extraordinary violence—often seven knots an hour during the ebb—and the Arab dhows have to wait for the slack water, which lasts not more than five or six minutes. To the north-west of the Ghubet-Kharab lies the Lac Salé. It is 436 feet below sea-level, and a large part of its surface is covered with a thick layer of salt, which is collected by the natives for export to Abyssinia.

The heat at Obock was mentioned in the note referred to. Numerous deaths from sunstroke have been reported of passengers who have gone ashore for a few hours from steamers lying in the harbour. Otherwise the place is not unhealthy, malarial fevers, so common in many other parts of Africa, being unknown. The *Khamsin*, charged with sand, comes on with great suddenness, and at the same time the thermometer rises with extreme rapidity, sometimes reaching 104° F., or even 113°, on the ground. The wet and dry bulb thermometers, which usually show a difference of 7° to 13°, then differ by 26° or even 29°.

On the shore of the Gulf of Tadjourah are situated a number of towns and hamlets, most of which are nothing but miserable collections of huts inhabited by a half savage population. The chief town on the northern side is Obock, where the French first established themselves. It was neglected by the Government until

1885, when it was made a coaling station in consequence of the war in Tonkin. It extends for a distance of 800 or 900 yards along the shore of the Gulf, and consists of a native and a European quarter. New streets have been planned, but, now that the seat of government has been moved to Djibuti, Obock is almost deserted. The surroundings are not so desolate as might be expected from the dryness of the country; a few trees and shrubs grow in the ravines, and the gardens of the natives, watered from wells, supply a quantity of vegetables in the season. Water can everywhere be found at a short distance from the surface, but it is unfortunately impregnated with sulphur, and the small stream which enters the Gulf near Obock is generally dry.

Djibuti is the only town on the south side of the Gulf, and has probably the best port on the coast of Africa as far south as Zanzibar. The entrance is protected by the Musha islands, and the port, a mile in length, affords shelter at all times to vessels. Abundant fresh water is obtained from the river Ambuli, a short distance off, and is brought into the town on the backs of camels. The temperature is more endurable than at Obock, as the winds are cooled in passing over the Gulf, and hence, while the thermometer rises to 113° F. at Obock, it does not mark more than 95° or 97° at Djibuti. The town has been built on the southern part of the plateau which terminates in Ras Djibuti, and already, with its houses of white stone, has an imposing aspect from the sea. Caravans, that formerly resorted to Zeila, now bring into Djibuti ivory, coffee, gold, musk, and other goods from Harrar and Shoa, and vessels of the French lines now call here instead of at Aden.

The Barotse Country.—In 1895 M. Alfred Bertrand, of Geneva, travelled through Rhodesia to the Zambezi, passing to its left bank above the confluence of the river Linyanti, often called erroneously the Chobe. The Zambezi was here 550 yards wide, and had a rapid current. Presently the party came to the affluent of the Zambezi named Machili, which they determined to explore to its source. A little way up, past the mouth of the river Kassia, the Machili was 270 to 330 yards wide and contained but little water, though in the wet season it must carry a considerable quantity. Indeed, a large part of the adjoining country is then probably inundated. Farther up the river runs in a valley skirted by low hills, the tops of which alone are covered with trees. The river Ramaroba, the chief tributary of the Machili on its right bank, marks the limit of the country of the Mankoia. They are subject to the Barotse, and are remarkable for their abundant hair, produced by a free use of castor oil. Armed with bows and poisoned arrows they live entirely on the products of the chase. At length M. Bertrand, entering on higher ground, reached the headwaters of the Machili, two small streams both dry at that season, and stood on the watershed between the streams flowing directly to the Zambezi and those that pour their waters into the Kafue. The country between the Machili and Lumbi, previously unknown to Europeans, consists of a succession of hills in general wooded, and intersected by the valleys in which flow the affluents of the Machili, Njoko, and Lumbi. The source of the Ikue, a tributary of the Njoko, was found in a charming lake of azure water which M. Bertrand called the Blue Lake. On the journey across this country he crossed the frontier of the Matolela, another tribe subject to the Barotse. They are not only agriculturists, but work the iron of the country. They are much superior to the Mankoia. What is called in Europe the Jewish type is very conspicuous among this people. At the river Lumbi the country changes its character; the hills are wider apart and the streams less numèrous. Large lagoons are scattered over the surface, some of which are connected with the Zambezi in the rainy season, receiving its surplus water. After passing the valley of the Sefula the party crossed a large plain, bounded east

and west by chains of hills, which is probably the bed of an old lake, and on August 17th arrived at Lialui, the capital of Lewanika, king of the Barotse. This people has subdued twenty neighbouring tribes, and the territory of its king extends from lat. 12° 30′ to 18° S. and from long. 20° to 27° 30′ E., with an area probably greater than that of France.—*Tour du Monde*, Jan. 23rd.

Narratives by Captain A. St. Hill Gibbons and Mr. Percy G. Reid, in whose company M. Bertrand travelled to the Barotse country, are contained in the *Geogr. Journal* for February.

AMERICA.

Topography in the United States.—The work of preparing the Topographic Atlas of the United States has been carried on since 1882, and the progress made is shown by Mr. Henry Gannett in a map published in the *Bull. of the Am. Geogr. Soc.*, No. 4, 1896. Four States only have been surveyed entirely, namely, Massachusetts, Rhode Island, Connecticut, and New Jersey. A large proportion of the work has been completed in West Virginia, Kansas, Virginia, and Maryland, and something has been done in nearly every State of the Union. In 1895 thirty-three topographical parties and three triangulation parties were in the field, and 48,066 square miles were mapped, 42,386 being mapped for the first time. 4000 square miles will be drawn on the scale of 1 : 62,500, or about a mile to the inch, and the remainder on the scale of 1 : 125,000. Seventy-five atlas sheets have been made ready for engraving, and parts of a number of additional sheets have been executed. At the rate of about 40,000 square miles a year, it will require sixty or seventy years to map the whole country, excluding Alaska. This seems slow progress, but probably in no other country in the world is so large an area mapped annually.

The Source of the Missouri.—Mr. J. V. Brower, whose name is already known to our readers in connection with the source of the Mississippi (vol. vii. p. 617), has contributed to the *Bull. of the Am. Geogr. Soc.*, No. 4, 1896, a few remarks on the source of the Missouri, accompanied by a map of the district. Professor Frank H. Bradley, Mr. Henry Gannett, and other surveyors have paid visits to the neighhood, but seem not to have explored the cañon whence the Missouri emerges into Centennial valley. In August 1895 Mr. Brower, accompanied by Mr. W. N. Culver, ascended the stream to the *caldera* where it takes its rise. This forms a thumb-shaped projection of the territory of Montana into the State of Idaho, a few miles east of the Red Rock lakes, and the source lies 8000 feet above sea-level. It is dominated by several peaks more than 10,000 feet high, to one of which, 11,000 feet high, the name of Brower Peak has been given, while the cañon has been named after Mr. Culver. The latitude of the spot is 44° 35′ N., and the longitude 111° 38′ W., and the distance from the Gulf of Mexico is 4221 miles (1276 miles from the mouth of the Missouri to the Gulf), while the distance from Nicollet's Infant Mississippi to the Gulf is only 2553 miles.

New Route to the Yukon.—Mr. Alexander Begg, our Corr. Member in Vancouver, has kindly sent us the following communication :—"The vast area north of British Columbia, that is, beyond the 60th parallel of north latitude, extending to the Alaska boundary and the Arctic Ocean, which has lately been named the Yukon District, is drained by the headwaters of that river and its affluents. On the south is the Pelly river, the basin of which extends to lat. 62° N. and long. 132° W. It is joined by the Lewes and Hootalinqua, the latter draining Teslin lake, which stretches for a distance of 100 miles from north to south, and penetrates twenty-five miles into British Columbia. The Pelly is

navigable for a distance of fifty miles by stern-wheel steamers. Another large river, the Porcupine, rises in 136° W. long., not far from the mouth of the Mackenzie, and falls into the Yukon in long. 145° W. on the Arctic Circle. It is navigable for 100 miles.

"The Cassiar district is drained by the Stikeen river, which enters the Pacific near Wrangel Island, and the Dease lake and river which flows north-eastwards to the Liard river. The latter is a continuation of Frances, which is the outlet of the lake of the same name, situated in about lat. 59° and long. 129°. The Liard and Dease unite about five miles south of the British Columbian boundary, and then flow to the Mackenzie river.

"Many years ago gold-mining was carried on extensively in Cassiar, along the Stikeen and the Dease river and lake. In 1876 the output was valued at $350,000, but in 1860 it had fallen $215,000, and from various causes has continued to diminish. On the other hand, mining and trade have greatly increased in the far north. During 1896 goods to the value of $750,000 were supplied to miners and others in the Yukon District, all of which were carried up the Yukon river by San Francisco trading companies. Large quantities of gold have been obtained east of the international boundary, in the Canada territory, where, it is reported, the richest mines are found.

"The great obstacle to the development of this region is the difficulty of carrying supplies into it. Miners are obliged to enter by the Chilcoot pass, north of Lynn Canal, an exceedingly difficult and often dangerous route, which has the additional drawback of lying for some distance in territory belonging to the United States. British Columbian merchants have not been able to introduce their goods into the country. To remedy this evil, it is proposed to open a new route entirely through British territory up the Stikeen river and across country for 120 miles to Teslin lake, and thence to East Yukon. The local government is to explore the country between the Stikeen and the Teslin, and the Dominion government will assist in opening the route, the best available in Dr. Dawson's opinion. A concession for a railway is to be applied for. The country through which it will pass is rich in mineral wealth, being a continuation of the mineral belt which traverses British Columbia. As Vancouver Island also contains considerable mineral resources, British Columbia is, perhaps, at the head of the mining countries of the world.

"The extreme northern situation of the Yukon region must naturally militate against its development. But the rigour of the climate is counterbalanced by certain charms. During the winter months, a writer who has resided near Circle City says, the aurora is very brilliant and intensely beautiful. It appears early in the autumn, and continues with more or less brilliancy throughout the winter. It is usually first seen at sunset, though in midwinter it is sometimes so vivid as to be visible when the sun is shining brightly."

Other notes on the country referred to, recording the explorations of Dr. G. M. Dawson, and Messrs M'Grath, Turner, and Schwatka, appeared in vol. v. p. 440, and vol. viii. p. 440.

Submersion of the Coast of Peru during the Quaternary Period.—Señor R. Rey y Basarde has traversed since 1867 long stretches of the coast of Peru, and has had frequent opportunities of noticing various indications of old strand lines. Level stretches with only slight inclines, covered with sand, rounded stones, and marine shells belonging to living species, old channels through which at one time evidently ran large volumes of water, old shores where the flux and reflux of the waves have piled up great barriers of sand, are some of the signs that the sea has covered these lands within the present geological period. Moreover, remains of ancient irriga-

tion works show that, since these regions were settled by men of a high standard of civilisation, water was near at hand where now is uncultivable waste denuded of every vestige of vegetable earth, while, on the other hand, the submergence of forests has been frequently proved by soundings.

One of the largest rivers of the arid littoral of Peru is the Rio de Santa, which even in the dry season, from May to October, contains such a large volume of water that it cannot be forded, while in the wet season it is a considerable stream discharging, when in flood, 100,000 to 140,000 cubic feet of water into the sea per second. Vegetation is abundant on its banks and in the valleys of its tributaries, and large quantities of timber are carried during floods down to the sea, where they are swept northwards by the Humboldt current, and, being stranded on the shore, form an immense rampart, as far as the Morro de Guañape, forty miles long, twenty to thirty feet broad, and eight to ten feet high, in which are piled up thousands of tons of timber. The country between the Rio de Santa and the Morro de Guañape consists of two pampas divided by the Coiscomba range of hills, which runs from east to west and is in great part covered with a layer of loose sand. Both pampas slope gently to the sea, and their surface is covered with a thick crust of efflorescent salts. Here are abundant traces of occupation by men who were far enough advanced in civilisation to irrigate the land by means of canals, strongly built and carried long distances in conformity to scientific laws. Subsequently these lands were submerged and were again raised above the waters, belts of dry ground appearing one after another at considerable intervals. The various shore lines are still marked out by rows of trunks. The land submerged by the first cataclysm was, Señor Rey y Basarde affirms, of greater extent than the portion which has been again raised in three successive stages, and among other proofs of this he cites the existence of a canal, which, issuing from the Rio de Santa, runs round the Punta de Chimbote to the northern side, where the Punta sinks precipitously to the sea. This canal, he believes, could have been constructed for no other purpose than to irrigate lands then lying at the base of the Punta de Chimbote and now covered by water.—*Bol. de la Soc. Geogr. de Lima*, Año v. Trim. 4°.

Off the Chilian Coast.—During a fortnight's cruise of the Chilian vessel *Presidente Pinto* to the San Felix and San Ambrosio islands, lying fully 560 miles from the coast, a series of soundings was taken between these islands and the archipelago of Juan Fernandez. Eighteen nautical miles from San Felix the depth was 219 fathoms, and it never exceeded 385 fathoms till a distance of 253 miles was reached, where it sank to 710 fathoms; at 330 miles the depth was 984 fathoms, and the same at 410 miles from San Felix. In 1890 the steamer *Relay* found much greater depths at a short distance from the coast (*Ann. der. Hydrographie*, 1891); in lat. 25° 42′ S. and long. 71° 31′ 30″ W. 4174 fathoms were sounded, and 4169 in lat. 24° 54′ S. and long. 71° 27′ 30″ W. It therefore seems that a submarine ridge must be situated here, on which stand the islands above mentioned. San Felix is composed of late volcanic rocks, has a fairly good landing-place, and is partly covered with a layer of guano twelve inches thick. San Ambrosio has no harbour of any kind, and only a few daring sailors have climbed its steep cliffs. *Geogr. Zeitschrift*, Jahrg. iii. Heft. 1.

OCEANS AND GENERAL.

The Prince of Monaco's latest Researches.—The report of the third cruise of the *Princesse Alice* has just been received. Between the months of May and August, 1896, eighty-two soundings were made in the Mediterranean and Atlantic at depths

down to 2737 fathoms, and in nineteen cases the temperature was taken, and nine specimens of water were collected. Samples of air were also obtained, one in the Azores at a height of 7464 feet, the others at sea-level far from the coast.

The Princesse Alice shoal, mentioned on page 599 of vol. xii., is situated between 31° 28′ and 31° 41′ N. lat., and between 37° 50′ and 38° W. long. Its perimeter is about forty-seven miles, and its greatest diameter runs from north-west to south-east. Its mean depth is 138 fathoms. The bottom is rock and volcanic sand, and the fauna is very abundant both in species and individuals.

The Prince of Monaco records a very curious incident connected with bird migration. From June 4th to 6th, between Monaco and Corsica, hundreds of swallows alighted on the vessel, and, on the evening of the 4th especially, made their way below, even into the engine and stoking rooms and the laboratories. The next day they took flies from between the fingers of the sailors and perched on their shoulders.

Another paper referring to the work done on the *Princesse Alice* is by M. Jules Richard, on an apparatus designed to show that the gases dissolved in sea-water at great depths is independent of the pressure. It consists of a bottle filled with mercury, the mouth of which is plunged in a bowl also full of mercury. When it reaches the required depth, the bottle is raised by a special mechanism, the mercury is replaced by water, and the mouth of the bottle is again lowered into the mercury. A sample from a depth of 1476 fathoms was taken to Paris and analysed by M. Th. Schlœsing, jun. The oxygen was diminished in quantity owing to the formation of rust, but the amount of nitrogen was little in excess of that demanded by theory for the temperature of 37·9°, the temperature at the depth. Hence M. Richards concludes that the quantity of gas is independent of the pressure, and is slightly greater than at the surface owing to the greater solubility at a lower temperature. Consequently, the bottles usually employed are quite satisfactory provided that some mechanism allows the pressure within the bottle to be constantly the same as the external pressure in spite of changes of temperature.

The Solar Eclipse.—Meteorological observations were taken at the Central Physical Observatory in St. Petersburg, on August 9th. Though the sun was low and the weather dull, a fall of temperature was noticeable in the air and at the earth's surface. At the beginning of the eclipse (4.51 A.M.) the air temperature was 55·4° ; at 5.45 A.M. it was 55·2°, and at the end of the eclipse (6.43) 55·7. At the earth's surface the fall was more marked. At Pavlovsk, where the sky was also covered with clouds, and rain was falling, the thermometer marked 56·6° at the beginning of the elipse, and 56·1° at the middle. A Sprung barograph showed a sudden fall of ·25 mm. before the contact, and a rise of ·75 mm. during the eclipse, falling again immediately after the eclipse. This rise, which has previously been observed during solar eclipses, is probably owing to the decrease of temperature, air creeping in above.—*Science*, Dec. 4th.

MISCELLANEOUS.

On September 27th work was commenced at Magione near Perugia on a canal which is intended to keep the water in Lake Trasimene at a constant level, and thus improve the sanitary condition of the neighbourhood.

Commissioners have been appointed on behalf of Great Britain and Canada to study, in conjunction with commissions from the United States, the feasibility of making a deep waterway for sea-going vessels from the American lakes to the Atlantic.

The Royal Society of Canada has resolved, during its next general meeting in Halifax, June 21st to 26th, to commemorate the famous voyage of the **Cabots to North America** in 1497, by the erection of a monument, or the placing of a tablet, in the province building of the city of Halifax.

Léon Chefneux, a well-known Abyssinian trader,* and the Swiss engineer Alfred Ilg, have founded a company for the construction of **Railways in Abyssinia**, and the Emperor Menelik has granted concessions for lines connecting Djibuti and Harar, Harar and Entotto, Entotto and Kafa, and Entotto and the White Nile.

By an agreement between the Russian and Chinese Governments, a railway is to be constructed across **Manchuria**. Starting from Onon on the trans-Baikal line it will cross the Chinese frontier at Staro-Tsurukhaituiavsk, will pass through Chichihar, Hwang-cheng, and Ninguta, and will terminate at Nikolskoie on the Southern Ussuri line. Out of the total length of 1270 miles, about 945 will be in Chinese territory. The work is to be commenced in August next, and will be completed in six years.—*Deutsche Rundschau*, Jahrg. xix. Heft 5.

The railway from **Tunis to Susa**, 94 miles long, has been completed by the construction of the section Bir-Bou-Rokba to Enfidaville, and thus Tunis is placed in easy communication with the oil-works of Susa and the vast domain of Enfida where four new colonies are to be founded. Work on the Tunis-Zaghouan railway is being pressed forward, and the line Susa-Kairwan has been surveyed. All these lines have a gauge of one mètre ($3\frac{1}{4}$ feet), intended for a speed of $15\frac{1}{2}$ miles per hour.—*Bull. de la Soc. de Geogr. Comm. de Paris*, No. 12, 1896.

The **Snake River** in the Washington Blue mountains has excavated its cañon through 3900 feet of nearly horizontal lava beds without reaching the crystalline rocks beneath. Prof. I. C. Russell estimates the full depth of these flows at 4600 to 4900 feet. The diluvial terraces here as in the other cañons of the district indicate a moister climate in former times, when the rivers were loaded with a larger quantity of solid matter. While the lava plains, 250.000 square miles in area, are waste and sterile, the products of weathering, piled up in large masses near the cañon, have by the help of artificial irrigation developed extraordinary fertility.—*Geogr. Zeitschrift*, Jahrg. iii. Heft 2.

An international commission has made a final report on the boundary between the **United States and Mexico**, thus ending all controversy concerning territorial rights on the Mexican border. From El Paso eastwards, the Rio Grande marks the frontier eastwards to the Gulf of Mexico. Westwards to the Pacific the distance is 700 miles, and along this line 258 iron and stone monuments have been erected, except where the Colorado forms the boundary. The commissioners suffered much from heat, sand, and lack of water. At Soyuota the mean temperature was 126° in the shade, and in crossing the Tule and Yuma deserts water had to be carried 100 miles.—*Bull. of the Am. Geogr. Soc.*, No. 4, 1896.

Adrien de Gerlache has been engaged in Norway last year with preparations for the **Belgian Antarctic Expedition**. He intends to sail from Norway with the *Belgica* on July 15th, and take in most of his stores at Antwerp. The *Belgica*, which is of about the same dimensions as the *Fram*, will be manned by a crew of twenty, among whom will be three naturalists. The eastern shore of Graham's Land will first be visited, where the vessel will stay from October to March. Then the expedition will sail to Melbourne to replenish its stores of provisions and fuel. The next year Victoria Land is to be the scene of operations. Scientific research is the chief object of the expedition, and not to reach the South Pole.

NEW BOOKS.

The Alps from End to End. By Sir William Martin Conway. With 100 full-page Illustrations by A. D. M'Cormick. Westminster: Archibald Constable and Co., 1895. Pp. 403. *Price* £1, 1*s. net.*

Sir William Conway had been climbing the Alps for some twenty-five years, when it occurred to him to strike out a new route which should occupy three months of average weather. This was nothing else but to do the Alps from end to end, passing as continuously as possible through snowy regions and traversing as many as possible of the more interesting and well-known Alpine groups. "By beginning with the smaller ranges at the southern extremity of the Alpine region, we were (says the author) able to start early in the summer season, with the maximum of time before us. The Colle di Tenda, over which goes the road from Turin to Ventimiglia, is regarded as the southern limit of the Alps and the boundary between them and the Apennines. Thither therefore we transferred ourselves on the 1st of June (1894). The first division of the journey was thence to Mont Blanc, which naturally had to be crossed; the line of route therefore lay partly in France, but chiefly in Italy, the Dauphiny mountains being of necessity omitted as lying aside of the direct way. At Mont Blanc we had to choose between two main possible ways. We might go along the southern Pennine, Lepontine and other ranges, or by the northern Oberland ridge and its eastward continuations. I chose the northern route as being shorter, and to me more novel. Arriving thus at the eastern extremity of Switzerland, the general line to be followed across the Tirol was obvious, the final goal being the Ankogl, the last snowy peak in the direction of Vienna, some 200 miles from the city."

During this excursion of eighty-six days, Sir William Conway's party climbed twenty-one peaks and thirty-nine passes. From Limone, where their journey may be said to have commenced, to Lend, near Wildbad Gastein, where it ended, they traversed on foot about 1000 miles.

To mountain-climbers this volume must be one of surpassing interest. Mr. M'Cormick's illustrations are excellent; but snow-pictures bear a family resemblance, whether they represent the Himalayas, Alps, or Cuchullins. From a practical point of view we should have liked a good map showing Sir William Conway's route, and indicating the place where he spent each night of his novel and enterprising journey.

En Algérie. Par Arthur de Claparède. Genève: Ch. Eggimann et Cie., 1896. Pp. 213. *Price* 3 *Fr.*

The President of the Geographical Society of Geneva visited Algeria in the spring of 1895, and here gives us his impressions of that Colony. He found that the two races, Arab and French, "are to-day as much estranged as on the morrow of the conquest. . . . At the bottom of his heart, the Arab always nourishes the desire to pitch the Frenchman into the sea; and although there is no fear of a general insurrection, an antipathy exists between conqueror and conquered which seems ineradicable. And how could it be otherwise? Nothing equals the contempt of the Frenchman for the Arab, unless it be the scorn or indifference of the Arab for the Frenchman." Written originally as a series of letters to the *Journal de Genève*, the style of this little book is at once light and attractive. As to the result of French colonisation in Algeria, the author says that a Genevese visitor was once asked by Marshal MacMahon, then Governor-General of Algeria, what

he thought of Algeria as a Colony? The reply of the Swiss startled the Governor, for it was, "I thought of what the English would have made of this country if it had belonged to *them*." The author considers that the English would have proceeded differently from the French, and he believes that the result would have been better. At the same time, he thinks that Algeria has a great economic future, and may enjoy prosperity, provided it receives colonists sufficient to people its still deserted territories, and steps are taken to remove the routine and administrative listlessness which trammel and enervate the Colonial authorities. The author makes some interesting remarks on Protestantism in Algeria, which, he states, has made great progress there, and is proportionally much stronger in adherents, and perhaps in vitality, than in France. Those who regret the tone of the Anglophobe French press in Egypt may find comfort in the author's observations on the local French press in Algeria, which, he says, continually inveighs against the authorities, and would lead its readers to infer that the best thing that could occur to Algeria would be for the French to haul down their flag and depart. The worst enemy of the colony, he declares, is the Algerian colonist himself, who does nothing but condemn the country, its inhabitants, and its institutions.

Travels in Unknown Austria. By PRINCESS MARY OF THURN AND TAXIS. London: Macmillan and Co., 1896. Pp. 143. *Price* 7*s.* 6*d.*

If a book by a Princess is to be judged by the same canons as that written by an ordinary mortal, we should say that this book is too discursive. It is, however, well illustrated, light, and amusing. Whilst the Princess was on a visit to Prince Hohenlohe, lord of the splendid castle of Duino overlooking the Gulf of Trieste, it was suggested to her to write a simple sketch of that part of Austria. From Duino she made excursions to Miramar, the Timavo and San Giovanni, Aquileia, Villa Vicentina, Sagrado and Gradisca, Capodistria and Goritz, and she records in this pretty little volume what she did and saw. Her personal experiences, however trivial, are carefully jotted down, even to the discomfort caused to her and party by drinking beer and eating ices at Count C.'s. Her last chapter is on "Nothing at all," and was written simply to avoid the fatal number thirteen.

Crags and Craters. Rambles in the Island of Réunion. By W. D. OLIVER, M.A. London: Longmans, Green, and Co., 1896. Pp. 213. *Price* 6*s.*

Originally this island was named Maroabyn or Margabin; in 1649 Flacourt called it "l'Ile Bourbon"; in 1792 the French Republic christened it "Réunion"; in 1806 Napoleon named it "Ile Bonaparte"; and now it is called "Réunion" once more. It once was famous as a health-resort, but, Mr. Oliver says, "its coast district's former reputation for healthiness must now be considered as at an end. In the mountains it is extremely healthy, but on the coast malarial fevers abound. A particularly virulent form of fever occurs, known as the *accès jaune*, which generally proves fatal in a few hours." Commercially the present condition of Réunion is very unsatisfactory, absentee landlords spending their money in Paris, instead of benefiting their starved estates in the Colony.

Geologically the island is very interesting, as all the rocks are volcanic, the highest mountain peak (Piton des Neiges) is 10,069 feet above the sea, and there is an active volcano in the south-eastern part of the island 8600 feet in height. Mr. Oliver ascended this volcano in September 1895, and describes in this volume his ascent, and the "crags and craters" he explored. Illustrations from his own photographs embellish his book, whilst a map of the island, based on that

of M. L. Maillard, is appended. It may be noted that there is a railway round the greater part of the coast, but it does not penetrate into the interior, so that the chief health-resort, Hell-bourg (named after Admiral de Hell, Governor of Bourbon from 1838 to 1841), and which is largely resorted to by people from Mauritius, Madagascar, and Réunion, is reached by road. Hell-bourg is 2900 feet above the sea, and its one drawback is rain and fog.

Documents and Maps on the Boundary Question between Venezuela and British Guayana from the Capuchin Archives in Rome. With a brief summary of the question by the Rev. Joseph Strickland, S.J., Litt. Doc. and Phil. Doc. Rome: Unione Cooperativa; London: Philip and Son, 1896. Pp. 76. *Price* 10*s.* 6*d.*

Although the Powers concerned have departed from the evidence of antique Roman documents, and have wisely resolved that the solid doctrine of prescriptive possession shall, for the first time in international quarrels, take the place of incorrectly and sometimes ridiculously drawn maps and nebulous treaties, such a work as this is of considerable archæological interest and value. The author states that the Spanish governors of the great colony of "Guayana de Orinoco" left the work of colonisation of the country, south of the Orinoco, entirely in the hands of Capuchin missionaries from Catalonia, "who gathered the Indians into small villages and attended both to the spiritual and temporal welfare of their flocks. The Spaniards did not attempt to go further than the Capuchins." The Capuchin Fathers in Rome having allowed the author to see and copy all the maps in their possession, he reproduces four in this volume, besides giving extracts from the private correspondence of the missionaries in Guayana from the Capuchin archives. The missionaries set to work in 1724, and in 1796 their mission stations had extended, according to the author's map, as far south as Cura, which is some distance to the north of Uruan on the Cuyuni river.

They never extended so far south as the 1841 Schomburgk line, claimed as the minimum British boundary by Lord Salisbury's Government; so that any argument founded on Capuchin mission stations must be in favour of the British Government, so far as the latter's minimum claim is concerned.

Mr. Strickland contributes to the discussion of the disputed territory an excellent coloured map showing the various frontiers proposed at different times. As, however, Great Britain, the United States, and Venezuela have agreed to settle the dispute as to what territory is British and what is Venezuelan upon the simple but sound basis of fifty years' continuous possession by British or Venezuelan settlers respectively, the mass of evidence contained in recent blue-books, as well as that specially furnished by Mr. Strickland, has been superseded by easier and plainer means of arriving at the truth.

The Empire of the Tsars and the Russians. Part III.: *The Religion.* By Anatole Leroy-Beaulieu. Translated, with annotations, by Zénaïde A. Ragozin. New York: G. P. Putnam's Sons, 1896. Pp. xi + 601. *Price* 12*s.* 6*d.*

The favourable judgment already passed in these pages on M. Leroy-Beaulieu's work must be extended to the present volume also. In some respects the subject is at once more special for the investigator and more generally interesting for the reader than those dealt with in the two volumes already published; and the author has zealously endeavoured to reveal the mysteries of strange sects, of which only

the few of the reading public know anything at all. On the broad view of his subject, M. Leroy-Beaulieu considers religion, both in the past and to-day, the corner-stone of the empire. "Tsarism—this anachronism in the midst of modern Europe—is in reality nothing but a patriarchal theocracy, disguised, through the compelling needs of the times and neighbourly influences, as military and bureaucratical autocracy." Religious unity is but a legal or State fiction in Russia to-day, although she still seeks for the unity of the State through religious unity. According to the author, the national church would gain more in depth than it would lose in area, were the policy of liberty admitted. Reasons of State, however, and "national exclusivism" militate against religious freedom.

The translator's work has been well done.

Der Weltverkehr: Seeschiffahrt und Eisenbahnen, Post und Telegraphie in ihrer Entwicklung. Dargestellt von Dr. Michael Geistbeck. 2^te^ neu bearbeitete Auflage. Freiburg im Breisgau: Herdersche Verlagshandlung, 1895. Pp. xi + 559. *Price M.* 8, *geb. M.* 10.

This is a well-written popular work, dealing with everything connected with transport and its transformations from the beginnings of navigation to the latest developments of ballooning, from the first royal messengers mentioned in history to the newest devices for sure and speedy communication by telegraph or telephone. Moreover, there are 161 illustrations and diagrams, and as many as fifty-nine maps.

The book is crammed with information about the history of navigation, railways, ballooning, ports and telegraphs; about the leading steamship routes and companies, the dangers to navigation and the means taken to diminish them; about the chief railways of the world, bridges, tunnels, etc., electric railways, mountain railways, street railways of all kinds; about the leading postal routes by land and water, and the different kinds of business carried on by post offices, the leading telegraph land lines and cables, and other matters connected with transport too numerous to mention in detail. An attempt is even made to correlate the peculiarities of the different railway services of Europe with the characteristics of each country and its inhabitants!

We learn that the fastest trains in the world in 1892 were the Hamburg-Köln express and the morning express from New York to Buffalo, timed at 84 kilomètres per hour. Our West Coast day express came next at 82 kilomètres per hour.

We are also told that the Norddeutsche Lloyd is the first and most important navigation company in the world; and of the "fourteen express steamers that in the modern sense alone can be so reckoned, the full half (seven) are German, and the remaining seven are divided between Britain, America, and France." The tables given show that the P. and O. have a larger tonnage than the Norddeutsche Lloyd, and that other companies have more, if much smaller, ships. In Dr. Geistbeck's list of express steamers the *Etruria* and *Umbria* have been omitted; they should have been included, raising the number of British express steamers to half-a-dozen, and the total to sixteen.

It is of interest to quote the amount of yearly subventions for the oceanic post paid by various countries in 1893. The United Kingdom spent £1,150,000 in this way, France £1,000,000, Italy £400,000, and Germany £350,000.

The information as a rule is accurate and interestingly arranged. Some of the tables of statistics, however, are rather carelessly compiled or revised. There are at least three misprints in the table on p. 114, and the distance from Southampton

to Melbourne by the Cape of Good Hope is given as 11,140 sea miles, and that from Liverpool as 13,140 by the same route!

The book contains many valuable references to literature, mainly German. The index is rendered rather inconvenient by being split up into four sections, one for each of the four parts into which the book is divided.

Principes de Colonisation (Bibliothèque Scientifique Internationale). Par J.-L. de Lanessan, Professeur agrégé de l'Histoire Naturelle à la Faculté de Médecine de Paris, ancien Gouverneur-Général de l'Indo-Chine. Paris: F. Alcan, 1897. Pp. 283. *Price 6 Francs.*

On the principles of colonial administration the views of so experienced an official as the author must necessarily demand attention. To do him justice, he speaks with no uncertain sound. In all he says as to the subordination of the various local authorities, their relations to each other, to the colonists, to the native inhabitants, and, lastly, to the different departments at home, there is little to criticise, and much, indeed, that to an Englishman is matter of course. How things ought to be done he illustrates emphatically by describing how things are, but ought not to be, done in Indo-China. He shows the civil and military authorities at open variance; the trader injured and systematically discouraged by those whose duty it is to support him; the interest of the colony studied only with a view to the profit of the *métropole*; worse still, the native inhabitants massacred, lands alienated without compensation, temples desecrated. When, after this, we find him hinting that the recent slaughter of cattle in Cape Colony, which we all supposed was intended to check the rinderpest, was really intended to create a famine among the natives, we quite see that, to a French student of colonial administration, such an accusation may not seem so entirely ridiculous as it does to us.

The author gives an interesting account of the grave mistakes made owing to ignorance of the relations existing between the different states—Cochin China, Cambodia, and Annam—under French protection: a subject also dealt with in his *Colonisation Française en Indo-Chine* (see vol. xi. of this Magazine, p. 433).

We are bound to remember that the writer is a disappointed man, and perhaps he "does well to be angry"; still, we do not often read so thorough a condemnation of a system written with full *connaissance de cause*. We may mention one among the minor mistakes he describes which had at least no tragical consequences. The Annamese and Chinese use the same ideographic signs, so that for the educated classes the two are mutually intelligible. The Roman Catholic missionaries, for their own purposes, ceased to use these signs in their schools in Annam, and introduced the ordinary Latin script. The French administration, mistakenly perhaps, adopted the practice and discouraged the acquirement of the ideographs, which have accordingly fallen entirely into desuetude. But the consequence has been that no one can now be found to interpret various old documents and title-deeds necessary for administrative purposes, and the confusion has been so great that an attempt is now being made to restore a knowledge of the old writing!

Names and their Histories, alphabetically arranged as a Handbook of Historical Geography and Topographical Nomenclature. By Isaac Taylor, M.A., Litt.D., Hon. LL.D., Canon of York; author of *Words and Places*. London: Rivington, Percival, and Co., 1896. Pp. viii + 392. *Price 6s.*

In this volume the learned and accomplished author of *Names and Places* has furnished a valuable supplement to that standard work. It is in fact a gazetteer and

a glossary of the place-names of the world, in which an attempt is made—generally a successful attempt—to explain the origin of the names borne by the countries, cities, and physical features occurring in different parts of the globe. The noteworthy facts mentioned in connection with many places give it also the character of a handbook of historical geography. In an interesting prologue Mr. Taylor discourses pleasantly on the difficulties, the dangers, the temptations, and even the monstrosities that beset the path of the student who inquires into the history and etymology of place-names. For example, a large crop of difficulties arises, as the author points out, from the fact that place-names, unlike other words, frequently outlive the languages from which they were originally derived, while new races, adopting and adapting these names, give them a twist or turn, so as to make them significant to themselves. There is some reason to believe that the name "Edinburgh" is a case in point. Mr. Taylor gives the usual etymology, which derives it from *Edwines burg*, that is, the fortress of King Eadwine of Northumbria, who extended his kingdom to the Forth. There are, however, Celtic scholars, of whom the Marquis of Bute is one, who maintain that the name is older than King Eadwine, and they urge in support of their view that there certainly was a fort of some kind on the Castle rock in Celtic times. While admitting that the suffix *burg* must have been added in Anglian times, Lord Bute holds that the stem was originally, not *Eadwine*, but *Maidan*, the name of a Celtic saint, sometimes found in the form *Aidan*. The form *Maidan*, it is contended, is found in "Maidenhead" (Berks), "Maidencombe" (Devon), "Maidenhayne" (Devon), and "Kirkmaiden" (Wigtonshire). That the same form must at one time have appeared in the name of Edinburgh Castle—in the form "Maidenburg"—is made at least probable by the well-known Latin translation, or mistranslation, of the name as "Castra puellarum." The contention, further, is that the form *Aidan* was transformed into the Anglian *Edwin*. Mr. Taylor does not seem to have met with this explanation, for he does not mention it among the possible etymologies of "Maidenhead." It seems to us that the point is worthy of his consideration. This book will be of great value, both to geographers and to philologists. Its value is enhanced by a series of essays in the appendix on "Indian Nomenclature," "Turkish Nomenclature," Magyar Names," "Slavonic Nomenclature," "French Village Names," "German Nomenclature," and "English Village Names."

Océanographie (Dynamique). Par M. J. Thoulet. Première partie. Paris: Librairie Militaire de L. Baudoin, 1896. Pp. 131.

Professor Thoulet's name is quite familiar to readers of this Magazine, his hydrographic work having been of a very high order. His former volume on statical oceanography was reviewed at considerable length in vol. vii. pp. 260-266, and we hope to do full justice to the later work when the whole has appeared. At present we confine ourselves to a mere announcement of the publication.

The Rivieras. By Augustus J. C. Hare, author of *Walks in Rome*, *Days near Rome*, etc. With 67 Woodcuts. London: George Allen, 1897. Pp. viii + 210. *Price* 3*s*.

We constantly and familiarly speak of "the Riviera" as if it were one region; but in fact there are two, namely, the "Riviera di Ponente," west of Genoa, and the "Riviera di Levante," east of Genoa, and between that town and Spezzia. Mr. Hare's title, in the plural number, is therefore fully justified. To the book itself it would be difficult to give too high praise. Its arrangement is admirable; its information is full, accurate, and evidently derived from immediate knowledge; its

historical and incidental references are most interesting and apposite; and its illustrations, which are genuine old-fashioned woodcuts, leave little to be desired, except that in a few instances the effect might have been improved by a stricter definition of details. A map, or in fact several maps, might have been introduced with advantage. It may be said that travellers have their own general maps to be referred to; but general maps are too often deficient in the details which a special guide-book gives or requires. The handsome little volume is, however, furnished with a full and serviceable index.

Guide to Shetland. With Illustrations and Map. By Robert Cowie, M.A., M.D. Fourth Edition. Aberdeen: Lewis Smith and Son, 1896. Pp. xv + 142. *Price* 1*s.*

Since the publication of the third edition of this *Guide* in 1879, several amendments, alterations, and abridgments have become necessary, and these are, on the whole, given effect to in the present work. The reference, however, to "a long period previous to the last sale of the estate" of Sand (p. 126) is erroneous and misleading in an edition of 1896, although it was quite correct in 1879. Nevertheless, the task of revising and condensing (by some eighty-five pages) the former edition has been well done; and the visitor to Shetland will find this little book a useful and handy pocket-companion. The rejection of the chapter on "The Poor Law," which closed the previous edition, in favour of a chapter on "Sport," is a very sensible idea.

Das Engadin in Wort und Bild. Textlich bearbeitet von M. Caviezel. Samaden: Druck und Verlag von Simon Tanner, 1896. Pp. 394.

This volume is not exactly a guide-book, though it contains a large amount of information on routes into the Engadine, hotels, etc. Its contents are, however, such as to interest visitors to the great health-resort of East Switzerland. The orography, geology, fauna, and flora of the country are described, analyses of the mineral springs are given, and there are chapters on the history of the valley and the social and political life of the inhabitants. The illustrations are numerous and well reproduced, and the volume is also enriched with a map from the Swiss Survey, geological profiles, etc. The book is well printed on good paper. It is one that will be useful to the tourist while in the Engadine, and will serve as a memento afterwards.

Fiji for Tourists. By Basil Thomson. London: published by the Canadian-Australian Royal Mail Steamship Line, N.D. Pp. 47.

No one is more capable of writing of the South Sea Islands than the author of this pamphlet. Here is a most interesting description of the group of islands comprehended in the name Fiji, with much useful information regarding their history, language, climate, etc., which ought to be appreciated by intending visitors, and give them some idea of the "glamour of the South Seas," which takes hold of most people who visit those islands. A journey to Fiji by the Canadian Pacific Railway and Canadian-Australian Steamers takes only twenty-eight days from London.

Sailing Directions for the Fiords, Ports, and Anchorages of Iceland. Compiled chiefly from Danish and French authorities by H. D. Jenkins, F.R.G.S. London : Imray and Son, 1896. Pp. 110. *Price* 4*s.*

Mr. Jenkins has compiled a very complete and useful book of sailing directions from the best authorities. The information on currents, ice, etc., is already accessible to British navigators through the translation of Lieutenant Wandel's work, published by the Hydrographic Office, but other portions of the work have not, we believe, appeared hitherto in English. The volume is well got up, and is provided with a good, though small, chart of Iceland. Hydrographic information relating to the Færöe is also added.

Beiträge zur Geophysik: Zeitschrift für physikalische Erdkunde. Herausgegeben von Prof. Dr. Georg Gerland, III. Band, 1 Heft. Leipzig : W. Engelmann, 1896. Pp. 216. *Price M.* 4.

Though this periodical has reached its third volume, it is probably unknown to most of our readers, and, indeed, the papers it contains are of too scientific a nature to interest them, unless they have a considerable knowledge of the foundations of science and, especially, of mathematics. By those, however, who are thus qualified to appreciate them, the articles in this number are well worthy of study. The first is by Dr. A. Schmidt on the aberration of the plumb-line, treated in connection with the measurements of earth shocks and tremors. There are also articles on the Clairaut theorem, relating to the form of the earth, by H. Hergesell ; on the Southern Aurora, by W. Boller ; on horizontal pendulum observations in the meridian of Strasbourg, and others. It would be vain to attempt an analysis of any one of these papers in the small space at our disposal, and therefore we must confine ourselves to a general recommendation of the publication to students of the physics of the earth.

The Journal of School Geography: A Monthly Journal devoted to the Interests of the Common School Teacher of Geography. 41 N. Queen Street, Lancaster, Pa., U.S.A. *Price* 15 *cents a number, or* $1 *a year for Ten Numbers.* Vol. I. No. 1. Pp. 1-32.

Geographical education is making steady if slow progress among English-speaking people. The other day the late Dr. Dalgleish, whose death is a great loss to this as well as other educational causes, presided at a meeting which formed a branch of the Geographical Association in Scotland. Since then we have received from New York a *Journal of School Geography*, with aims similar to that of the teachers of geography who form the Geographical Association : "to advance in every way possible the cause of good geography teaching in the elementary and secondary schools."

Although this journal is the first devoted to school geography published in English, it is by no means the pioneer journal of geographical education, for German schoolmasters have long possessed such an organ, which has done valuable work in furthering sound methods of teaching geography. We hope the present publication may have a useful and profitable existence, and that all teachers of geography will make its acquaintance.

Each of those responsible for the journal is a "worker in geography, either as investigator or teacher, or both. Every one is now teaching or has taught ; all

have to do with the problems of the schools; and several are making these problems their chief study." The editor-in-chief, Dr. Richard E. Dodge, is one of the Professors in the Teachers' College, New York. With such experienced teachers and geographers the journal ought to be practical, and indispensable to the schoolmaster who teaches geography.

The first number contains an article on "Home Geography," full of suggestive remarks, by Professor Davis of Harvard University; some wise "Suggestions regarding Geography in Grade Schools," by Dr. Dodge; an interesting account of "Geographic Instruction in Germany," by Dr. Munroe; a short paper on "Some Things about Africa," by Mr. Cyrus C. Adams of the *New York Sun*; and a series of reviews and notes.

We wish this new venture every success, and hope it may soon appear simultaneously on both sides of the Atlantic.

The Story of our Planet. By Professor T. G. Bonney, D.Sc., F.R.S., etc. London: Cassell and Co., 1896. Pp. 592. *Price* 10*s.* 6*d.*

The author of this attractive work warns us that it is not a text-book, "nor designed to prepare for an examination," but is intended for those persons of good education who, whilst much interested in the history of the earth, have neither leisure nor inclination to master the technicalities of science. Written in plain lucid English, garnished with 170 excellent illustrations, the *Story of our Planet* is capable of being read with interest by non-scientific persons. The only criticism one might make is that the author has not carried out the Story as fully in the spirit of his preface as he might have done. Thus he devotes very little space to a subject which is most attractive to the general reader, viz., what Lyell called "the Geological Evidences of the Antiquity of Man." However fascinating palæontology may be to the geologist, the author, when dedicating his work to the general reader, should have remembered that no work of creation is so interesting to the latter as Man. Thus, to the latter, the researches of Pengelly are far more interesting and instructive than those of Davidson. Yet in the work before us, whilst investigations such as those of Kent's Cavern are not referred to at all, other cave-researches are very cursorily treated. In the same way, whilst to the geologist the evidences of a prolonged Glacial Epoch may be a subject of engrossing interest, to the general reader the rude but spirited sketch of the mammoth found in the Dordogne Caves (given at p. 528) far surpasses in interest all the long dismal tale of an age of ice. Perhaps, in a future edition, the learned author will carry out the full spirit of his preface, and give Man his rightful place in his *Story of our Planet.*

Elementary Palæontology (Invertebrate). By Henry Woods, M.A., F.G.S., Demonstrator in Palæontology in the University of Cambridge. Second Edition. Cambridge University Press, 1896. Pp. xiii+296. 112 Figs.

The second edition of this useful book has been enlarged by about 80 pp.; the number of illustrations has been doubled; the bibliography has been judiciously extended; and the word Invertebrate has been added to the title-page, though not to the outside cover. We still think that the correct title has not been attained. The book is really a guide to a collection of typical Invertebrate fossils, and as such it deserves both praise and success. But Palæontology—even elementary palæontology—is more than this, the Tripos examination notwithstanding. In

short, as we said before, we miss in these pages a sufficiently explicit recognition of the fact that palæontology spells history—a *Werden und Vergehen* of races.

Die Europäischen Kolonien. Schilderung ihrer Entstehung, Entwickelung, Erfolge und Aussichten. Von Dr. ALFRED ZIMMERMANN. Erster Band. *Die Kolonialpolitik Portugals und Spaniens; in ihrer Entwickelung von den Anfangen bis zur Gegenwart.* Dargestellt von Dr. ALFRED ZIMMERMANN. Mit einer Karte in Steindruck: Uebersicht des portugiesischen und spanischen Kolonialbesitzes gegen Mitte des 16 Jahrhunderts. Berlin: Ernst Siegfried Mittler und Sohn, 1896. Pp. 509. Bibliography and Map.

Dr. Alfred Zimmermann has set himself a task of writing a brief, consecutive account of the colonial policy of all modern European nations, this first volume dealing with those of Portugal and Spain, which, as he justly remarks, were the models upon which all other colonial policy has been based. Next year the volume will appear dealing with British colonial policy, to be followed by others on that of France, Holland, and Germany.

Taking a great interest in German colonial policy of the present day, the author has been constrained to give considerable attention to the experiences of those peoples who were the pioneers in colonising lands beyond the sea. He found —as does every one who studies the subject—that, although there was considerable and detailed information concerning definite and limited epochs or persons, yet he could find no handy comprehensive work dealing with different nations; for he remarks that the colonial politician can only use the seldom-read works, such as those of Handelmann, Neumann, Gervinus, and Saalfeld.

His main object in this work is to educate himself, for, as he says, it would be impossible for one man to deal with such a vast subject in a strictly scientific manner. He has used all available information—books, monographs—as well as parliamentary papers and reports. We do not remember any work by a British author on exactly the same lines. Our literary men seem more inclined to write on matters of temporary importance; but it might be well, we think, were they to follow the example of this author, and so enable our statesmen to base their colonial policy on a comprehensive knowledge of the subject, and so to avoid errors they are constantly falling into by a remembrance of those made in the past.

This volume is divided into two almost equal parts, and gives an admirably condensed *résumé* of the colonial policy of Portugal and Spain from its inception to the present day. It is a fascinating book to read, not overloaded with detail, and a crisp, vivid picture is given of the whole events of the history of the adventures, gains and losses, ups and downs, of these two great colonial powers; and, reading between the lines, one can readily see from our author's description the causes which have led to the enormous curtailment of their colonies.

We do not think there is anything to choose between the two parts of the book; both are alike admirable, and give the careful reader, as in a nutshell, all the salient events which have taken place since Henry the Navigator instituted his adventurous voyages.

Quotations would be useless. Readers must peruse the book from cover to cover, and they will thank Dr. Zimmermann, as we do, for his work, and trust that he will be as successful in his forthcoming volumes.

NEW MAPS.

ASIA.

INDIA, Geological Map of ——. Prepared under the direction of R. D. Oldham, A.R.S.M., Superintendent, and published at the Geological Survey Office. Corrected to December 31st, 1892. W. King, D.Sc., Director, Geological Survey of India. Scale 1 inch = 32 miles, or 1 : 027,520.

Presented by the Director of the Geological Survey of India.

AFRICA.

UKAMBANI UND DEM KENIA-GEBIET, Originalkarte von ——. Nach eignen Aufnahmen von 1894-96 gezeichnet von Joh. George Kolb. Massstab 1 : 1,000,000. *Petermanns Mitteilungen, Tafel* 17, 1856.

SOMAL-LANDE, Reiseroute des Fürsten Demeter Ghika Comanesti im ——, 1895 u. 1896. Nach den Aufnahmen des Reisenden bearbeitet von Prof. Dr. Ph. Paulitschke. Massstab 1 : 2,000,000. Nebenkarten ; Ansicht der Dschigo-Kette : Profil der Strecke von Labansalé bis Djigdjiga ; Profil der Routenstrecke zwischen Madêsso-Mündung und Bérbera.

Petermanns Mitteilungen, Tafel 18, 1896.

KILIMANDJAROGEBIET, Das ——, zwischen Moshi und Taweta. Nach den hinterlassenen Schizzenblättern von Dr. C. Lent. Massstab 1 : 100,000.

Mittheilungen aus den Deutschen Schutzgebieten, Bd. ix. Heft 1.

USSAGÁRA, UGÓGO, UHÉHE, UND MAHENGE, Neue Aufnahmen deutscher Offiziere in ——. Herausgegeben von Dr. Richard Kiepert. Massstab 1 : 500,000.

Mittheilungen aus den Deutschen Schutzgebieten, Bd. ix. Heft 2.

ATLAS.

ATLAS AND DICTIONARY bound together. *Price* 1*s.* 6*d.*

William Collins and Son, London and Glasgow.

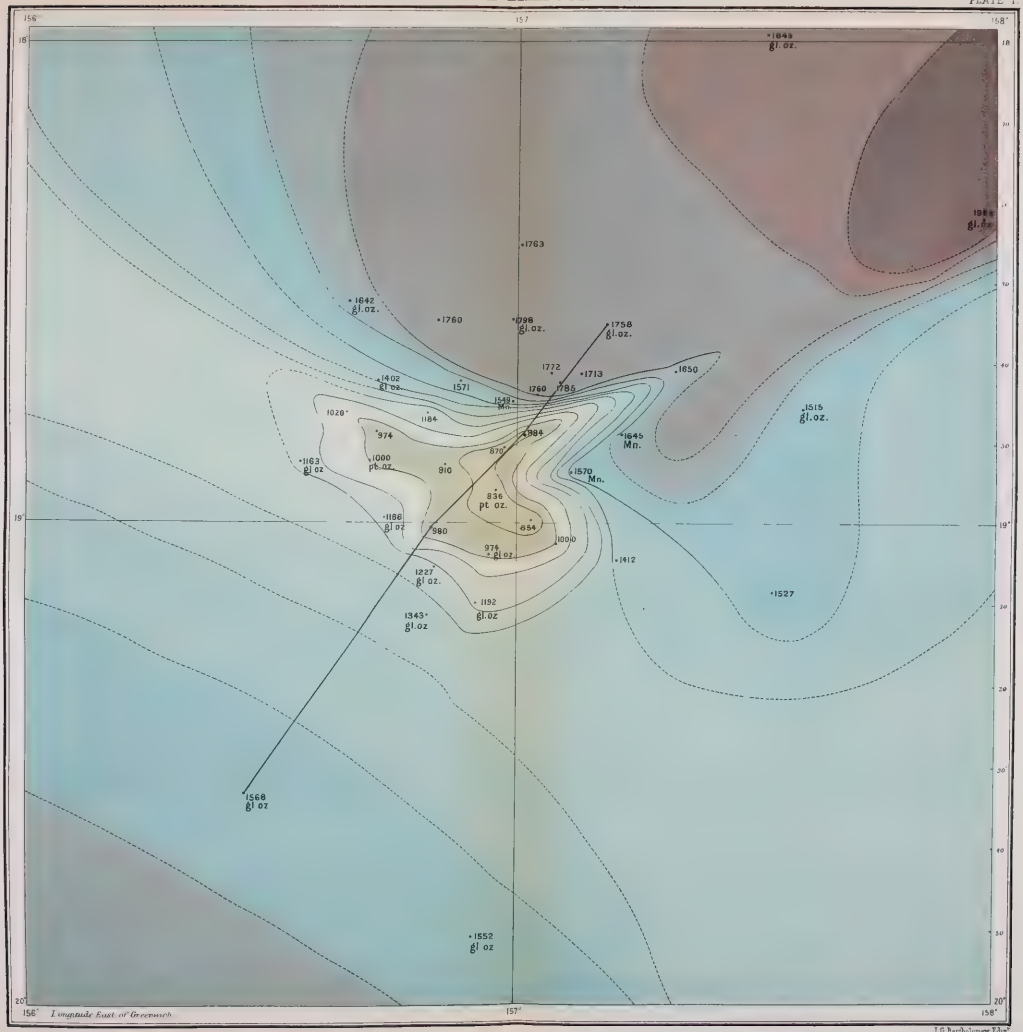
Forty roughly executed maps form the first part of this volume. Some are not up to date ; in others the colours are so confused that it is impossible to distinguish the territories that belong to each individual Power. Some of the photographic views which follow are very fair productions, and these certainly constitute the best part of the book. The English dictionary, which, curiously enough, is bound up with the preceding parts, we can hardly praise ; as a specimen, we may quote the following definition :—"Stereoscope : an optical instrument through which two objects appear as one." It is difficult to believe that this work will hold its own against the well-planned and well-executed atlases that some firms now turn out, at prices low enough to meet the demands of schools.

CHARTS.

HONDURAS BAY. Port Livingston and Approaches to Dulce River. Hospital Bight. From a Survey in 1896 by the Officers of the U.S.S. *Dolphin*, Commander W. T. Burwell, U.S.N., commanding.

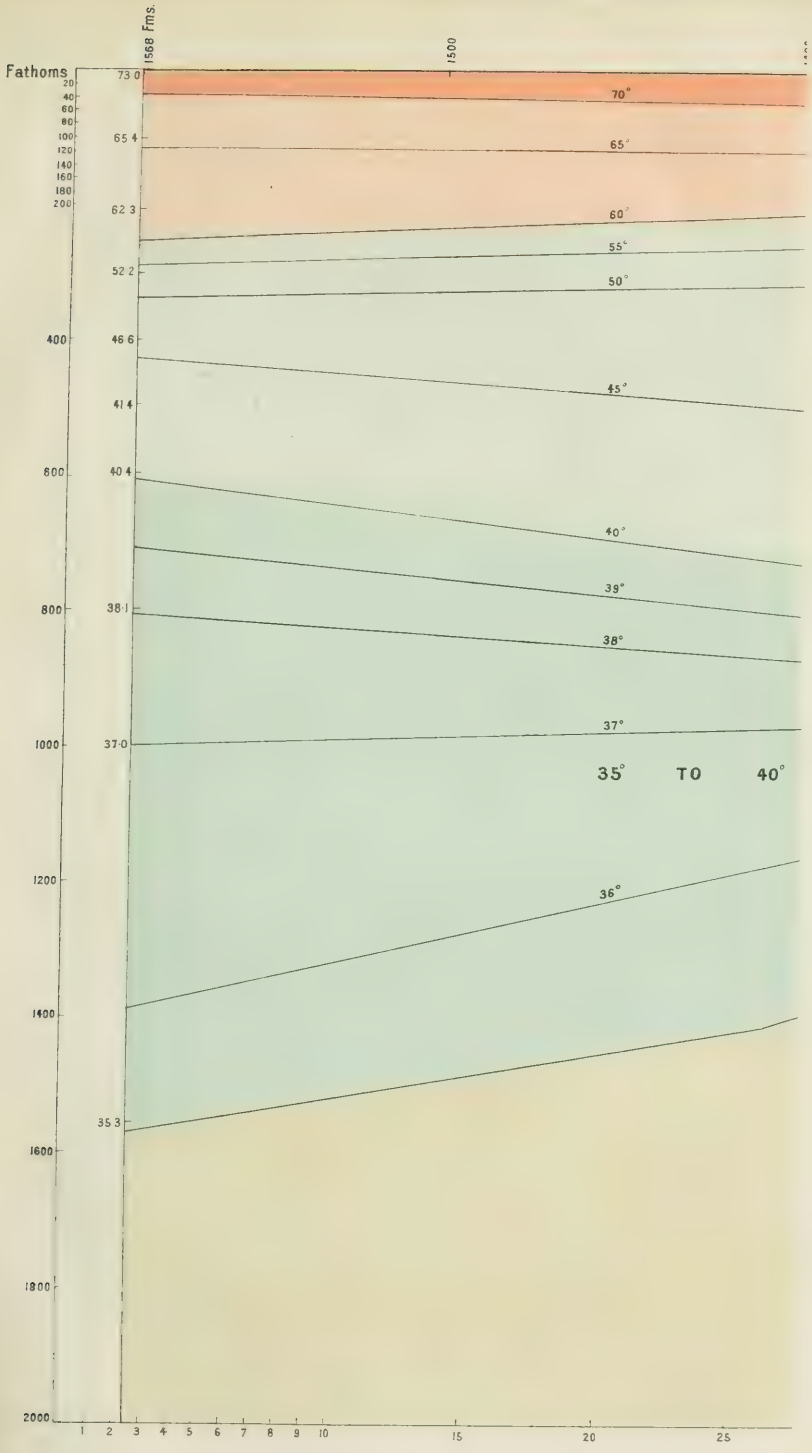
Presented by the U.S. Hydrographer.

MAP SHOWING THE DEPTH, PTEROPOD AND GLOBIGERINA OOZES AROUND THE BALFOUR SHOAL



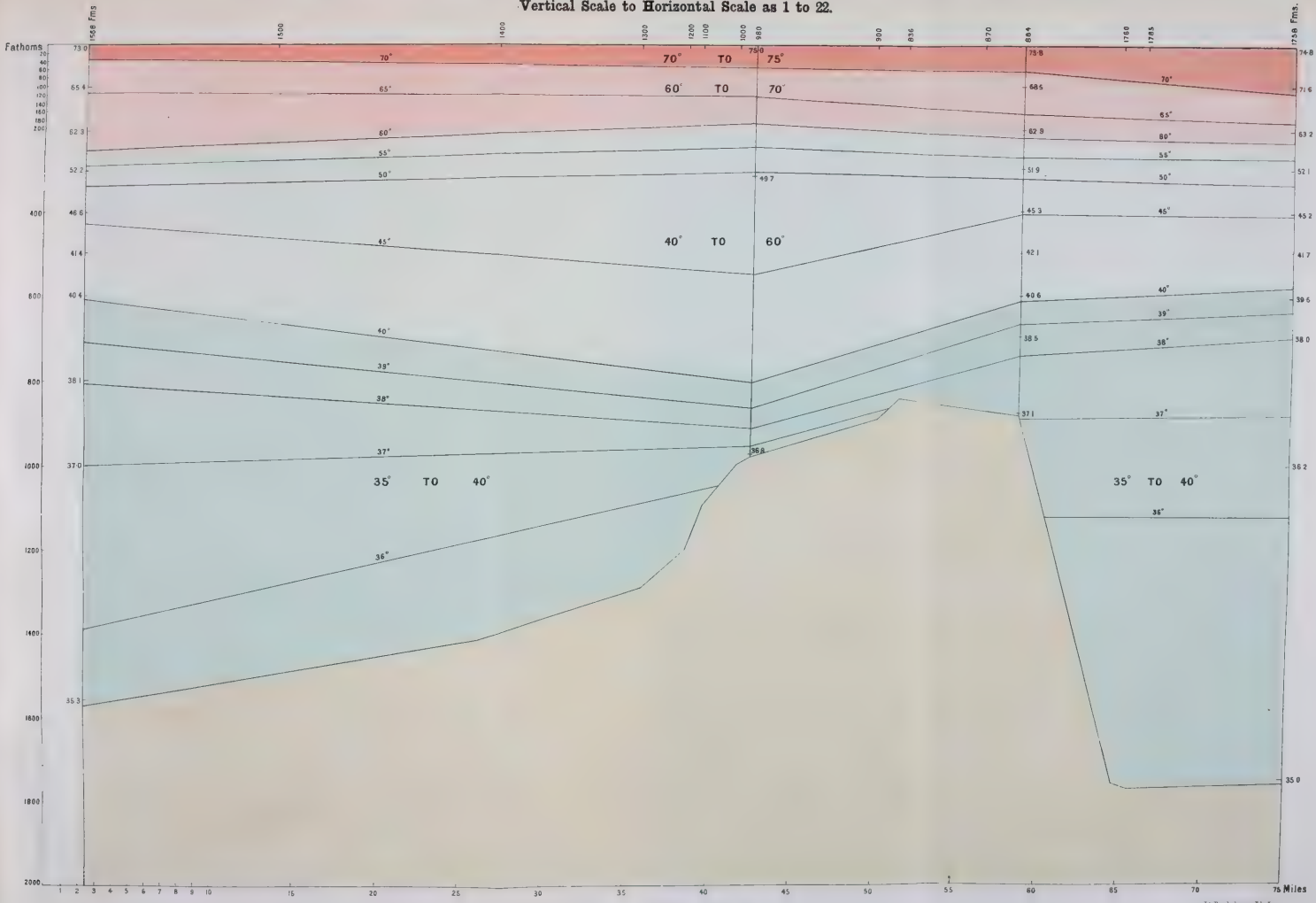
Pteropod Ooze Deposits *occur inside 1000 Fathom Line where depths are shown in shades of Green*
Globigerina Ooze Deposits *occur outside 1000 Fathom Line where depths are shown in shades of Blue & Purple*

SECTION ACROSS THE BALFOUR



SECTION ACROSS THE BALFOUR SHOAL SHOWING THE TEMPERATURES TAKEN 10th TO 12th AUGUST 1894.

Vertical Scale to Horizontal Scale as 1 to 22.



THE SCOTTISH
GEOGRAPHICAL
MAGAZINE.

CEYLON.

By L. B. Clarence,
Late a Judge of the Ceylon Supreme Court

(*Read at a Meeting of the Society in Edinburgh, on February 25th.*)

I must confess that I feel some diffidence in addressing you to-night. It is true that I have spent many years in Ceylon, and travelled much about the island, very often on foot. But yours is a scientific society, and I am no scientist. Since, however, your Society has paid me the compliment of desiring me to address you, I will do my best to give you some account of the country.

Ancient Communication with Ceylon.

The harbour of Galle, at the south-west corner of Ceylon, is one of the world's very oldest ports of eastern trade. Plausible reasons have been given for believing it to be the Tarshish of the Bible. However that may be, it was undoubtedly a port to which, in days of hoar antiquity, traders—Indian, Arabian, and perhaps Phœnician—came coasting down the western shores of India to receive the produce of the Farther East, and bring it back to meet traders from the West. Afterwards, in the dawn of the Christian era, a daring seaman, Hippalus, made a new departure in eastward navigation, which gave a startling impulse to Eastern trade. He noted how steadily the monsoon winds blew across the Indian Ocean, alternately from the east and west, and he conceived the idea of being wafted to and fro by their aid, instead of laboriously coasting round. He launched out from the Arabian coast, headed boldly across the open sea, and reached the shore of Southern India.

I think a parallel might be drawn between this old Hippalus and our Dr. Nansen. In very different climates they displayed similar qualities of calculation and daring. One reasoned about the currents of the air: the other about the currents of the sea. Each had the courage of his opinions, and each proved to be in the right.

Hippalus' discovery led to something like definite information reaching Southern Europe about Ceylon. Prior to that, only very vague hearsay about the island had reached the Greeks and Romans. Meanwhile, long before the Christian era, the Sinhalese in Ceylon had their towns, elaborate buildings, and great irrigation works. But they were never a seafaring people, and they paid little heed to foreign commerce.

Of course Northern Europe had no knowledge of these Eastern regions till a much later date. So far as our own nation is concerned, Ceylon for a very long time lay far outside our track of Eastward travel. The first of our countrymen who adventured Eastward made their way to the Levant, thence overland to the Persian Gulf, and so on to India and the Farther East. Our Indian Empire had risen high above its foundations when Ceylon was still an Ultima Thule, of which little was known in Britain.

The world's highways have changed; and now the current of Eastward traffic strikes full upon the island. More than 30,000 passengers pass through the port of Colombo every year. Ceylon has become the half-way house between Europe and the Far East and Australia—a highly important item in the British Empire. Her harbours offer invaluable "opportunities of port" in relation to India. Moreover, a large import and export trade has developed between Ceylon and Britain, and the island is the seat of a large planting enterprise.

Ceylon never part of the Indian Continent.

You see how close Ceylon lies to India, with the interval almost bridged over by a line of reefs and sandbanks known as Adam's Bridge. It looks on the map as if the island had once been joined to India—as if Adam's Bridge were the remnant of a solid connection. The earliest scientific writer about Ceylon (a brother of Sir Humphrey Davy) said that no one could look at the map and not see that that must have been so. Now, scientific opinion is the other way: there are further materials to go upon. It is thought that Ceylon and India never were united—that Adam's Bridge and the Northern peninsula of Ceylon are of recent formation, the result of coral reefs and alluvial and sandy drift. I believe, opinion now is, that long ages ago, when the plains of India were still ocean bed, the high lands of Ceylon formed part of a great Southerly continent, the rest of which has been long since submerged. There are variances between the fauna and flora of Ceylon and India, which are considered to support this opinion.

Adam's Bridge ends in a sandy islet about eight miles long, called Ramisseram, between which and the Indian shore is a passage by which small shipping can pass through from east to west. Now and again a

scheme has been mooted for enabling larger shipping to get across, by cutting a ship-canal through Ramisseram; but the cost would be large, and it is very doubtful whether the canal could effect a saving of time which would make up for the canal dues. Moreover, by this route ships would forego the call at the important port of Colombo. A more likely scheme is that for an Indo-Ceylon railway, which is now seriously taken up.

Climate.

Now, as to the climate. The intense heats of the hot season in the plains of India are not known in Ceylon; but, on the other hand, there is no cold season, no winter. There is a word for ice in Hindustani, but none in Sinhalese or Tamil. Still, the island having a mountain roof, up which a railway now climbs, Europeans who have time and money may command a climate where, if the sun smites fiercely at noon-tide, the nights are cool, or even cold. You may leave the sweltering heat of Colombo in the morning, and at night be glad of a blazing wood-fire and a pair of blankets. The climate compares favourably with other tropical climates, and the opening up of the country has improved many malarious places. With care and discretion, a European may live a healthy and vigorous life in the island, especially if he has access to the hills and comes home occasionally. The planters in the hills are a decidedly healthy and vigorous set.

Yet we miss our own climate. There is a wearisome monotony in nearly equal day and night all the year round, and trees perpetually in leaf. We miss the changing seasons of home—the fall of the leaf, and the winter when the earth sleeps, till budding spring ushers in the glory of summer. Surely for us there is no climate like our own. And when all is said, in a tropical climate, even of the best, we live, as it were, on sufferance; and the climate tells on the next generation. For every one of us who has his livelihood in Ceylon, there comes the inevitable day when he must part from his children, and send them home. This stern necessity has been styled a price which we pay for our Eastern possessions: and a heavy price it is.

In spite of the small size of Ceylon—only four-fifths as large as Ireland—the annual rainfall varies in different parts from 200 inches down to 33. This is because the island lies right in the track of the monsoons, and has a high mountain roof, which condenses the watery vapours, and so produces periodic rains. Of course, vegetation and scenery vary signally in the dry and the moist regions, the hills and the low country. The driest parts are in the north-west and south-east, where the moist winds sweep across without encountering any hills. These parts exhibit a good deal of scorching sand and dry, thorny scrub. The wettest parts are to the south and south-west of the hills. Their steamy atmosphere is trying to European constitutions—you feel as if you were in a perpetual poultice.

The mountain roof which so affects the rainfall is a central tract about fifty miles square, walled in on three sides by a loftier mountain rampart. The highest summit in the enclosing rampart, Pedurutalagala,

is 8296 feet, and the country inside attains 7000 feet. A map published in 1844, under the auspices of the Society for the Diffusion of Useful Knowledge, marks a large tract north of the central region as "unknown mountainous" country. But that is really a level tract. Nowadays old maps are often found to have been somewhat imaginary.

Geology and Scenery.

As to geology:—the island consists largely of old sedimentary rock and gneiss, with occasional granite and some basalt. Huge upheavals must have taken place at some remote periods. Layers of shells several feet above the sea at places along the south coast indicate that those parts were submerged down to a much later date. The land is still slowly rising, especially along the west coast.

The gneiss varies in texture. In some places it is hard and weathering slowly: elsewhere with an excess of felspar, and decomposing quickly under water. Perhaps to this latter incident may be due the frequent occurrence on some of the highest rocks of holes resembling the pot-holes found in torrent-beds. Dolomite, yielding good lime, exists in some parts of the Kandyan country, and secondary limestone beds underlie the red soil of the Jaffna peninsula; but in general limestone is rare, and the lime used in building is burned from the coral on the coast.

Laterite, a product of the disintegrated gneiss, known in Ceylon as *cabuk*, overlies the gneiss in many places, and is used in building. Plumbago, mined in several districts, is exported largely.

Iron-ore exists of several kinds, some exceedingly pure, and the iron-slag of old Sinhalese smeltings is largely strewn about the country. This industry has almost died out. British iron is now so cheap, and fuel for smelting less easy to command.

Nitre may be got in many places, but attracts little or no attention.

The late Sir Samuel Baker believed that gold would be found in the hills in paying quantities, and the Sinhalese word for it occurs in many names of places. Prospecting, so far, has never resulted in more than slight indications of the metal.

Ceylon from very early times has been noted for the gems found in the granite *detritus*. The main seat of this somewhat speculative industry is near Ratnapura, below Adam's Peak; but old gem-pits exist high up in the mountains, and elsewhere. The most valuable stones are sapphires and cats'-eyes; the rubies have less value, but some of the cheaper stones—amethysts, garnets, and particularly the cinnamon stones—are very pretty. The opalescent stones, styled moonstones, are quarried out of the rock in the neighbourhood of Kandy. These gems are cut somewhat rudely with the aid of the corundum found in the country.

The soil of the island is in general shallow and very poor; the best is in the hills, and between them and the west coast, and there the coffee and tea planting developed. The soil of the Jaffna peninsula, overlying limestone, is more fertile. There, as on the Indian coast, the Palmyra palm is largely cultivated. A rather rank tobacco is also grown there, and in a few other places.

In the Low country the gneiss often crops out in bare slabs of large extent, tufted with euphorbias and other rock-haunting vegetation; and a very striking feature is the torrid, precipitous masses of rock, towering abruptly for hundreds of feet above the plains. Some of these great rocks were fortified in old days; great boulders were hewn and scooped into floors and baths, and large fissures converted into temples, whose gloomy vaults are plastered with historical paintings of great age.

The south-west coast is fringed with coco-palms, stooping in endless vista over the sandy bays and rocky headlands, past which fly the brown-sailed fishing-canoes, hollowed out of a single log, and steadied by a heavy outrigger-beam lashed alongside.

At Dondra, the southernmost point of the island, beneath the fringe of feathery palms, and almost in the roar of the sea, stands a lone group of stone pillars, the forlorn remnant of a great temple destroyed by the Portuguese in 1587; and here, as you look southward across the tumbling waters, there is no land between you and the Antarctic ice-fields. In these days Dondra is a populous fishing-village; and I remember it as noted for the large manufacture of forged deeds.

High up in the mountains there is a lovely savagery of rock and precipice, shaggy forest, torrent, and waterfall; also tracts of open grass land, which the Sinhalese call *Patanas*, studded with great rhododendron trees—not bushes, but great trees—amidst whose glossy, dark-green foliage blaze large clusters of crimson blossoms, through which the sun gleams wine-red.

The Government now reserves, as a climatic reserve, all forest above 5000 feet: below that line most of the mountain forest has disappeared, converted into planting estates—a singular combination of trim cultivation, precipice, and torrent, huge rock boulders and the skeletons of the big timber lying tossed about in wild confusion.

Adam's Peak.

I cannot pass without a word the grand mountain which we call by its Portuguese name of Adam's Peak—only the fourth in height (7352 feet), but far the grandest. Its Matterhorn-shaped pinnacle stands up like a sentinel on the south-west bastion of the hills, visible at Colombo, forty-five miles away, and far out at sea. During the north-east monsoon, from November to April, its needle stands uplifted in the brightness of the dawn, suffused with a clear flush of faint rose, like the incandescence of molten metal. In the other months Colombo beholds the Peak towards evening, outlined in grey behind the inland horizon of feathery coco-palms. Away inland it suddenly towers upon you as you rise to some pass in the lower hills, and find yourself face to face with its hoary majesty, in lone watch on its mountain rampart. Whether sharply defined in still, clear air, or mysteriously veiled in cloud, it is ever an awe-inspiring vision, and we cannot wonder that the imagination of mankind has invested it with the sanctity of religion.

For over fifteen hundred years the Sinhalese have flocked in pilgrimage to the summit, because they believe that two thousand four

hundred years ago the founder of their religion, Gotama Buddha, left his footprint on the topmost crag. Tamils and Hindus associate the mountain with Siva, and Mohammedans with Adam.

The easiest ascent of the Peak is from the planting district of Maskeliya, where you may start from some hospitable bungalow, only a few miles from the last steep bit of the climb, called by the Sinhalese the *Lakana-gaw*—the Sky-league. That way, also, you get a start of 3000 feet, or more, in elevation.

I myself prefer the track which mounts on the other side, direct from the low country, by a Sinhalese path, twenty-six miles from Ratnapura, the last twelve miles winding upward through the forest in a succession of steep gullies, rugged staircases of rocks and tree-roots, worn deep by water and the feet of millions of pilgrims. Near the top the path emerges on to an open, rocky slope, not unlike the dome of St. Paul's, in full view of the sheer depths below. Here the climbers are assisted by iron chains and stanchions let into the rock. On the very top, protected by a little shrine, is the Holy Footprint, the *Sri-pada*. In the rainy months the *Sri-pada* is deserted, but in the dry season a few yellow-robed monks abide there, and thousands of pilgrims—men, women, and children—toil up the steep. They lay their little offerings before the Footprint, and strew sweet flowers, and then the children kneel and receive their parents' blessing.

At early dawn the Peak casts its shadow clear across the visible world and high into the very sky—a spectacle of indescribable grandeur. When I first saw it we had passed the night close to the top, and moved up a few minutes before daybreak. As the swift tropical dawn advanced, and there began to be light, we seemed to be standing on the shore of a wide sea rippling to our feet, with here and there a little rock rising above the surface. The seeming sea was the clouds stretched out below, and the little rocks were the tops of the lower mountains. Then, as the sun's rays broke from beneath the eastern horizon, the awful shadow of the Peak streamed out westward, intensely black, like a lingering slice of the night projected across cloud and plain and distant sea, its point resting high up in the æther of the sky. For a few moments the mighty shadow rested so, athwart the visible world, in unspeakable majesty, and then, as the sun's orb mounted the horizon, it faded gradually away.

History.

Two native languages are spoken in Ceylon, Sinhalese and Tamil.

The ancestors of the Sinhalese were an offshoot from a wave of Aryan emigration, which in prehistoric times flowed southwards from Central Asia, and settled in Bengal. Thence, about 600 B.C., they swarmed into Ceylon, and speedily settled the island, supplanting the aboriginal inhabitants, of whom a few fast disappearing remnants linger in the south-east wilds, under the name of Veddahs. About that time the Buddhist religion arose in India, and about 300 B.C. an apostle of Buddhism converted the Sinhalese. Buddhism, though long vanished

from its Indian birthplace, is still the religion of the Sinhalese. The great ruins of their cities, palaces, temples, and irrigation works, attest the large population of those days. The centre of their activity was in the north central country.

The palmy days of the Sinhalese lasted till about the fourteenth century A.D. Meanwhile they were more or less in constant collision with the ancestors of the Tamils, now settled in the north of the island—a Dravidian people, hailing from the Dekkan and thereabouts, whom the original southward Aryan wave had failed to exterminate or absorb. At last the Tamils had the upper hand. The Sinhalese abandoned one after another their royal cities in the north central country, and shifted their capital hither and thither in the south. When the Portuguese appeared on the coast, early in the sixteenth century, the two races were dwelling apart, the Tamils up in the north, and the Sinhalese more to the south.

Tennent, the historian of Ceylon, remarks that everything which tended to civilise or embellish was the work of the Sinhalese, while the Tamils, with all the power which they exercised, contributed only to ruin and debase.

The great Mohammedan invasion of India never reached Ceylon; but when the Portuguese came, a race of Mohammedan traders of mixed Indian and Arab blood, akin to the Moplahs of the Madras Presidency, had possession of the seaports, and were acquiring considerable influence. The Portuguese styled them "Moors." They now number about 300,000, and are keen traders. The Moormen's shops are in every village, and the Moorman pedlar, with his smart jacket, and his high woven cap of gaudy colours, marvellously adhering to his shaven skull, and his assortment of gems and curiosities, is the first to greet the passenger on arrival.

The Portuguese established a chain of forts and factories round the coast, especially on the south-west, held them for about 150 years, and then were ousted by the Dutch, who in their turn, after nearly another 150 years, were dispossessed by Great Britain.

The Portuguese came for spice, especially cinnamon, and also sought to propagate their own religion. They built churches up and down the west coast, and baptized many of the coast folk. The Dutch were centred on their endeavour to wring from the country a profitable export. They also strove to efface all traces of the Portuguese and their religion, regarding both with an aversion hardly to be wondered at in men whose forefathers had gone through blood and fire in the days of Philip II. and Alva.

Yet the Dutch form of Christianity made no way among the people, while many of the natives on the west coast still profess the Roman Catholic religion, and bear Portuguese names. If the Portuguese had been fierce and cruel, the Dutch were hard and griping. Each people jealously restricted trade to its own monopoly, and each administered the settlements at a heavy loss. Neither succeeded in subduing the interior.

It was in the Portuguese times that the first recorded traveller from Britain visited Ceylon. This was one Ralph Fitch, who touched at Colombo in 1589, on his way home from the Far East. He was one of

four adventurers sent out by the Levant Company to prospect for eastern trade, and the only one who ever returned. Probably this expedition had something to do with the founding of the East India Company a few years later. There is a curious circumstance as to Fitch's journey. Macbeth's first witch knew a sailor, whose husband was "to Aleppo gone, master o' the *Tiger*." There really was a *Tiger* trading to the Levant in those days, and Fitch actually sailed in her for Aleppo. He did not sail *to* Aleppo, because, as you know, Aleppo is not a seaport, but he landed on the coast, and so made his way to Aleppo, and thence on to the Persian Gulf and to India and the Far East.

The Dutch forts, grey and grass-grown, still remain in many places round the coast. On the west coast the Dutch made about a hundred miles of inland navigation, by canals connecting the rivers and lagoons.

The Roman-Dutch law, which they introduced into their settlements, though much intrenched upon by British legislation, has never been actually repealed, and still survives, in a decayed and semi-obsolete condition. Its confused remains have even been allowed to creep into the interior, even into places where no Dutchman ever set foot. All this is very unfortunate. These confused remnants of Dutch law are not in harmony with the great British development which has taken place since the Dutch cleared out of the island. This law suits neither the native inhabitants nor the British traders and planters. It merely adds an element of uncertainty and confusion; and nothing in law is so disastrous as uncertainty. Far better were it repealed absolutely.

British Rule.

When we took possession of the Dutch settlements in 1796 the interior was unsubdued, and contained nothing like a road, and hardly anything that could fairly be styled a town. There was no really orderly native government. The Sinhalese capital for the past two hundred years had been at Kandy, in the lower hills, about seventy miles from Colombo. Between it and the coast the Kandyan kings maintained a belt of dense forest, with the passes guarded. In the north central region, where in the old days the Sinhalese population had been most dense, there was then a silent waste of forest, thinly inhabited, in which lay buried the remains of towns, temples, and great irrigation works. This great depopulation was doubtless due to the incursions of the Tamils and the decay of the ancient irrigation works.

At first our new possession was placed under the East India Company, but that arrangement did not work smoothly. The Company's service was not then what it became afterwards. The Madras officials intrusted with the administration were neither discreet nor honest. The Sinhalese rose in revolt, and when the revolt had been suppressed, the Settlements were withdrawn from the Company and placed under the Colonial Office as a Crown colony.

If our coming had been delayed till the East India Company's service had become what it has since become, all might have worked

smoothly, and in that case Ceylon would probably at this day be administered as part of our Indian empire.

I think that the development of commerce, and especially the European planting enterprise, has been as successful as it could have been under the Indian Government: perhaps in the case of the planting even more so, for the planters have probably commanded more influence under the Colonial administration than they would have had under the Indian.

But legislation in general, and particularly the adjustment of the administration to the needs and traditions of the people, would probably have fared better under the Indian Government. Legislation in India has been more skilful. A government on a greater scale commands a higher order of skill and talents. What is of more importance, these difficult tasks have been advised in India by men armed with knowledge and experience of the people, acquired in working lives spent among them. Ceylon, sharing the cares of the Colonial Department with a host of "Colonial" dependencies all over the world, most of them very unlike herself, has been less fortunate. The administration has been less in touch with the people, and less cognisant of their needs.

In 1815 we annexed the interior of the island, which as yet had known no European ruler. A determined revolt of the Kandyans took place in 1817, and a much less serious one in 1848. Since then the country has been tranquil. Even when India was shaken by the Mutiny there was no corresponding manifestation in Ceylon.

Early in the twenties, under Governor Sir Edward Barnes, a veteran of the Peninsular war, the work of opening up the island by roads and bridges was begun, and pushed forward with marvellous despatch and success. The people highly valued this work. It is recorded that when, years afterwards, a statue of Sir Edward Barnes was erected in Colombo, a railing had to be placed round it, to prevent its receiving inconvenient attention as an idol.

It would have been well if all our work in the island had been as good as this, but our legislative work has been less happy. The forces of nature are easier to reckon with than the habits and idiosyncrasies of mankind: and few tasks are so difficult as that of adjusting law and government for an Eastern people.

There is no time, and no need, for me to attempt a description of all that followed in the wake of the roads. The country was "opened up," as the phrase is, and its resources developed. Hospitals and medical aid came into being, and all sorts of things which you will easily imagine. Of the Planting enterprise I shall speak presently. The first railway was engineered up into the mountains, for the accommodation of the planters. Afterwards low country extensions were made, and more are in contemplation. Since then some experts have thought that the railway might have taken a better route, that it was unnecessarily and ill-advisedly engineered by a costly route across high mountains. As to that, I do not presume to offer an opinion.

Harbours.

Colombo, successively the headquarters of the Portuguese and the

Dutch, is our seat of government. The Portuguese occupied it, and the Dutch retained it, because it lay close to the cinnamon country; but till the day of our great and successful breakwater, begun in 1875, finished in 1883, and now being supplemented with a north arm, Colombo had no merits as a seaport, for it possessed only an open roadstead, where no shipping could enter or lie during the fury of the south-west monsoon.

I have already spoken of the antiquity of Galle as a resort for shipping. Ships could enter and lie there all the year round. It was a convenient port when eastward traffic came round the Cape, and up to less than thirty years ago it was still the principal port of call. But Galle harbour is rocky, and the attractions of Colombo prevailed.

Trincomali, on the east coast, has a natural harbour possessing every advantage—deep water, complete shelter, ample space, and easy access at all times. Sir Emerson Tennent, in his Account of Ceylon, published in 1859, earnestly advocated the transfer of the capital to Trincomali, and predicted that the change would one day be forced on the Government by the planting body. But the desire of the planters has not moved that way. On the contrary, since Tennent's day, their agitation has been for railway communication between the hill planting districts and Colombo. The attainment of that desire, *plus* the Colombo breakwater and the convenience of a west coast port, has probably dissipated all chance of Colombo ever ceasing to be the capital.

The People.

The population of the island is now about 3,300,000. Europeans number barely 6000; most of them, excepting the civil servants, being connected directly or indirectly with the planting interest. This unofficial European element in the population is relatively much larger and more influential with the administration than anything of the kind in India. The Mohammedans already mentioned—the "Moormen"—number about 300,000. There are about 10,000 Malays, mostly in Colombo or in the south, or employed in the police, and about 22,000 Eurasians of mixed native and European blood. The Sinhalese outnumber the Tamils by about two to one.

The Tamil population includes about 250,000 immigrant coolies from South India, working in the planting districts. The Jaffna Tamils, resident in the north of the island, the descendants of the invaders who followed the Sinhalese into the island, never come as coolies to the planting districts. They are densely crowded in the Jaffna peninsula, and have spread some way down the coast, especially on the east. Where they come the Sinhalese retreat inland.

The Sinhalese are less enterprising and astute than the Jaffna Tamils, but possess more kindly qualities, and are less persistent and cynically adroit in falsehood and chicanery. Their religious buildings are not befouled with the licentiousness of the Tamil temples. Caste distinctions are observed by the Sinhalese, but with less of quasi-religious sanction than among Tamils or Hindus.

It must be admitted that the people of Ceylon, like other Eastern races, are addicted to untruth, to the use of the law courts, civil and criminal, as instruments of fraud and oppression. These failings, born of racial character, are largely fostered by defects in our legal system. The people are more untruthful in our courts than in their villages. Life would be unbearable if in daily village intercourse there were such an anarchy of untruth as the law-courts witness.

Outcry is sometimes made for some summary procedure to punish and check native perjury and fraud. But these practices are best checked by strengthening the administration of justice so as to deprive them of success. Unfortunately the Government endeavoured to discourage litigation by the expedient of high stamp-duties on law proceedings. This visits the fraudulent and the innocent with one common penalty, and tends to increase crime, as the people, unable to obtain justice in the courts, attempt to take the law into their own hands.

The Sinhalese of the maritime districts have gradually diverged in various respects from the Kandyans. The two seldom intermarry, and the Kandyans, as might be expected, retain more of ancient usages, which once, no doubt, were common to the whole nation.

The Kandyans are strongly attached to what are called "associated marriages"—that is, Polyandry—two or more brothers living with the same wife. This is a usage known also in other parts of Asia, and, according to Cæsar, it obtained among the ancient inhabitants of Britain. Some years ago the Government of Ceylon passed an enactment expressly forbidding these associated marriages. This was well meant, but ill judged. The practice is revolting to our ideas; but deep-rooted national usage cannot be broken through merely by prohibitory legislation. The associated unions continue, though deprived of legal sanction, and the legislation merely results in quarrelling and litigation.

The Kandyans recognise two kinds of marriage—marriage in *binna* and marriage in *diga*. In the *binna* marriage the husband comes to live with the wife in her home, and may be turned out at her pleasure. In the *diga* marriage the wife follows her husband to his home, and loses her share of her father's land.

Rather from ignorance than intentional disregard, the Government has too little regarded the traditions of joint family ownership which exist, though in a less elaborate form than in India, where they have been wisely and humanely recognised. The people, the Sinhalese especially, are devotedly attached to their family lands; but, unhappily, the Ceylon Government, unlike the Government of India, has dealt with the land on the modern English principle of individual ownership and free trade in land, causing the land to be sold under civil writs for enforcement of fines, and even for maintenance of prisoners in gaol. No one who has not known the country can realise the unhappy results of this—heart-burning, litigation, violent crime, and misery. The man who has become landless very frequently ends by being a thief.

An interesting incident of ancient Sinhalese land-tenure is the manorial village, termed *Ninde-gama*, with its mansion-house, called the *Walawwe*, its demesne lands, and its tenants, holding lands by tenure of

service,—the whole bearing a striking resemblance to the English manor, and passing even more rapidly to extinction.

Unhappily our Government for many years held aloof from the native gentry, and with unfortunate results. Their influence, if properly encouraged and controlled, would have been an invaluable aid to order and well-informed administration.

The expressions in daily use among the Sinhalese folk for the measurement of distance or time might sound strange in your ears.

A long distance is the *gow*,—the distance an active man may be expected to walk in an hour.

Ask a man, "How far is So-and-so's house from yours?" He may reply, "It is within a talk,"—*i.e.* so near that the people can talk backwards and forwards to each other. If a little further off he will say, "It is within a loud talk." If further yet, it may be, "Within a 'hoo-call.'"

If a man be asked in the witness-box, "What time was it when so-and-so happened?" he very likely raises his arm skyward and says, "The sun was so high before (or after) sun-turn." Or he may say, "There were so many feet of human shadow before (or after) sun-turn." Or perhaps he may say, "This happened about the time when priests eat." (The Buddhist priest, or rather monk, is supposed to take but one "square meal" *per diem*, viz., about 11 A.M.) Or he may say, "About the time when bees play" (about 4 or 5 P.M.); or "About the time parrots fly home to roost."

His tillage he measures by the amount of seed required to sow the plot. He may describe a plot of ground as of three *seers* sowing extent, which is much the same as saying three quarts.

You may sometimes hear expressions used which are almost poetic. A girl who had been forcibly abducted from her home described her feelings, when she found herself hurried away to a lonely place in the jungle, by saying, "I felt like a bird that has fallen into the sea."

Many of the ancient irrigation works, by means of which the Sinhalese cultivated paddy, are now in ruins; but under our rule some of the abandoned tanks have been restored. The Sinhalese are also clever in cultivating paddy on very steep hillsides by a process of terracing, termed *aswedduma*. Very many of the people get very little rice, and make their staple food of corocan (*Eleusine corocana*) and other very small grains, dry-grown, eked out with yams and other vegetables. It is centuries since the island can have produced rice enough for its inhabitants. The rice supply for the planters' coolies is all imported.

Quite lately the tax on paddy cultivation has been abolished—a measure as to which the advisers of the Government differed in opinion. The truth is, that the hardship which the people felt was not so much the tax itself—for they had been accustomed to an impost under their own sovereigns—as the oppressive incidents of its collection by the renters to whom it was farmed out, and the forced sales of the land itself over the villagers' heads, sometimes even when the crop had failed for lack of water.

The people now enjoy useful European products to which their fore-

fathers were strangers; yet, step by step with this, ancient industries seem to be dying out. I have already mentioned the iron-smelting. The people used to wear cloths woven and dyed in the country—cloths which absolutely would not wear out. Now they get less durable fabrics from Europe. The silversmith, too, is abandoning his old patterns and imitating cheap European trinkets. 'Tis pity that the old native arts and crafts should die out; and may we not wonder how the people reconcile missionary teaching with some of the wares that reach them from Christian Britain? Knives made to sell but not to cut; bottles and pots that hold scarce the half of what they ought to hold, and so on.

There are no native troops in the island. The Sinhalese and Tamils are not soldier material, like the Sikhs, Gurkhas, and other fighting races of India. A few years ago a volunteer battalion was enrolled, consisting mainly of town-bred natives and Eurasians. I believe Lord Wolseley has expressed in pretty round terms his opinion of a Eurasian battalion. Lord Roberts also has seen reason to rate rather low the fighting value of the peoples of Southern India. I once commanded a company of these Ceylon volunteers, and am disposed to describe them in the words of Dryden—

> " . . . maintained at great expense,
> In peace a charge, in war a weak defence."

The village folk have courage in their own way, as those can testify who have seen them in the presence of big game; but the people of the towns lead another sort of life, and the Eurasian has not in him the makings of a soldier. This volunteer battalion would be a very broken reed to lean upon in emergency. There are also some European artillery volunteers and mounted planters, who are metal of another sort, and these would, no doubt, give good account of themselves.

Forests.

The whole area of the island is rather less than 25,000 square miles —a little under 16,000,000 acres—of which by far the greater part is uncultivated. Allowing for land unsuitable for forest, and sundry other deductions, there ought to be nearly 4,000,000 acres of good timber forest; and the island grows many kinds of useful timber, besides valuable ornamental woods, such as ebony, satin-wood, and calamander. But a few years ago Mr. Vincent, an able forest officer, was borrowed from the Indian Government to report on the Ceylon forests, and this gentleman, in a most valuable report, had to announce the unwelcome discovery, that much of the good timber, and indeed a great deal of the forest itself, no longer exists. For want of a good forest system much of the timber had been poached away, but the wholesale disappearance of the forest itself was due to the native practice of *chena* cultivation, a practice followed under other names in India and Burmah.

The villager clears and burns off a block of forest, raises a crop or two, and then abandons the plot, and perhaps proceeds to clear another. By operations of this sort, repeated at intervals, the soil becomes

impoverished, or even quite exhausted, and at best the character of the vegetation is changed and the forest replaced by a poor, stunted growth. The practice is no new one. It no doubt increased after the Sinhalese Government had fallen to pieces; but the worst of the mischief was probably done after we came. Mr. Vincent's Report (which incidentally included a terse and excellent summary of the physical geography of the island, to which I am much indebted) led to the inauguration of a Forest Department on the Indian model.

In most of the existing forest the undergrowth is well-nigh impenetrable, save along a beaten path or a game-track. It consists largely of a plant which the Sinhalese call *Nilla* (*Strobilanthes*), of which there are thirty-two varieties, all peculiar to Ceylon. It grows to eight or ten feet high, flowers every seven or eight years, and then dies down, leaving the ground strewn with a litter of dry, pipe-like stems. When it flowers, the rocks and trees in the high jungles are hung with nests of bees, from which large quantities of honey are brought away.

Vegetable Products.

Ceylon has 172 orchids—some ground orchids and some epiphytal. Though not so gorgeous as the South American, some are very handsome, and some delicately scented. I fear that a few of the handsomest run risk of extinction from the wholesale manner in which the plants are torn up and carried away, generally to perish after removal.

I should have liked to describe some of these Ceylon orchids to you, but time forbids. I believe that no Cattleyas exist in Asia, and no Dendrobiums in America. The Dendrobiums are well represented in Ceylon. The *Dendrobium MacCarthiæ*, called by the Sinhalese *Wesak-mal*, because it flowers in the month *Wesak*, is peculiar to Ceylon, and not common even there. It throws a pretty frond of lilac and white blossom which lasts for some weeks; but repeated experience shows that it absolutely refuses to live in Britain.

Ceylon has now, for many years, possessed a most admirable Botanic Garden at Peradeniya, near Kandy, with branches in the mountains and in the low country. The late Dr. Thwaites and the late Dr. Trimen, its curators, were botanists of European reputation.

A tropical island seems specially liable to be invaded—or, shall I say, reinforced—by foreign vegetation. In Ceylon it is not always easy to say what is indigenous and what exotic. A remarkable instance of an exotic which recently has made itself thoroughly at home, even to the overpowering of native vegetation, is the *Lantana*, which is steadily spreading eastwards from the west coast, covering old clearings with an impenetrable tangle eight or ten feet high.

The cinnamon is probably not really indigenous; the coffee and tea and cacao certainly not. Indigo was introduced and failed. Sugar also is a failure. The cane grows freely, but, owing perhaps to the poor soil, its juice is deficient in saccharine matter. Citronella oil, extracted from a coarse grass in the south, used to pay, but for many years low prices have discouraged this industry. Cotton grows, and cotton mills have been started near Colombo.

Ancient Remains.

Ceylon has no ancient inhabited cities such as may be seen in India. The ancient works of the Sinhalese lie in ruins, buried in forest. You may mount some steep, forest-covered slope and find it to be the embankment of a great forgotten tank, dry these hundreds of years, and long overgrown with heavy timber.

Some of the old works of the Sinhalese palmy days have been uncovered in our time. At Anuradhapura the clearings have laid bare much of the ancient royal city, and now a trim, provincial station, with its *kachcheri*, and hospital, and other offices, stands amid the ruins of long streets, palaces, and *dagobas* — wildernesses of carved stone. These *dagobas* were huge domes of solid brick, enriched with stone pillars and carvings, built to enshrine relics. The oldest was built about 300 B.C. They were very lofty—some said to have been 400 feet high : the ruins of some are still over 200 feet.

At Anuradhapura may be seen the oldest authenticated tree in the world, the sacred Bo-tree of the Sinhalese (*Ficus religiosa*), a species of banyan, grown from a branch, brought from India in 288 B.C., of a tree associated with the founder of the Buddhist religion.

Animal Life.

I have no time to say much about animal life. The Indian tiger, hyæna, wolf, cheetah, and the great gaur are not found in Ceylon : but there are elephants, panthers, bears, buffalo, several kinds of deer (including the tiny *Mimiuiya*, no larger than a cat), pig, jackals, monkeys, etc., and there are some monkeys, squirrels, and other animals peculiar to the island. The jungle-cock of Ceylon is distinct from the Indian.

Of course the great opening up of the country has much diminished the amount of game. Peacock, for instance, are very much scarcer than they used to be. The native practice of water-hole shooting in the dry season involves a great slaughter of deer. Close times are now enacted, but not much observed by the people in the wilder regions.

Many years ago there were sportsmen who had killed their hundreds of elephants. Sir Samuel Baker speaks of three guns killing 104 in three days. There used to be a Government reward of 10s. a tail. Now, restriction is placed upon the slaughter of elephants. There are still plenty in the wilder parts of the low country, but with the clearing of the mountain slopes for planting they have almost disappeared from the hills.

Now and then a herd of elephants is *corralled*, sometimes when distinguished strangers visit the island. The *corral* is a large and strong enclosure built of great logs in the deep forest, and having one entrance, opening from a long, funnel-shaped approach. The herd is driven perhaps for weeks by some hundreds of beaters. If the drive is successful, the herd at last enters the corral, then the gate is made fast, and the captives are noosed and secured at leisure by the aid of trained tame elephants.

Pig-sticking, as practised in India, would be barely practicable in such a country as Ceylon, which is less rideable than India; but the planters up in the higher hills have good sport hunting Sambhur-deer (locally termed "elk") afoot with dogs and knife.

It is curious to find some of our British birds reappearing in Ceylon in precisely their European form, but with their colours changed. For instance, Ceylon has two robins — unmistakable robins, but not red-breasts—for one is sooty black, and the other magpie black-and-white. The starling's plumage is plum-purple, with a yellow streak across the eye.

In a few places are found the edible birds'-nests which the Chinese so prize. The bird, I believe, is really a swift. The nests which I have seen were in the very centre of the island, rather small, and but moderately furnished with the gelatinous substance.

The sea and the low-country streams and waters teem with fish. The mountain torrents look as if they must harbour trout, yet they contain only a few loach. Within the last few years a well-arranged attempt has been made to stock some of the higher streams with trout, and the attempt is thought to be succeeding. I hear of two-pound and three-pound fish being taken in streams where the fry was turned out not very long ago. Still, it remains to be seen whether the trout will really breed and multiply. The previous absence of fish must have had some cause—perhaps the dearth of insect food—which may prevent the fish from multiplying. Let us hope, however, that the venture will succeed.

I must say a word about the pearl fishery, which takes place every now and then at the pearl-banks on the north-west coast. It dates from very ancient times indeed. When the Portuguese began to build their fort at Colombo in 1520 they at first resorted to the enormous deposits of pearl-oyster shells on the north-west coast. The fishery is in the hands of the Government, and brings in an occasional windfall. The divers come from the Malabar coast, and receive a stated share of the pearl-oysters. They are really mussels and not oysters. The fishery lasts several weeks, and the Crown share of each day's take is sold by auction at prices varying from fifteen up to seventy or eighty rupees per 1000 oysters. There is a gambling element in the speculation which seems attractive, especially to the Moors, and many thousands of people flock to the desolate, sandy shore off which the fishery takes place. The actual fishery is only part of the undertaking. A temporary town is laid out, with Government offices, *kachcheri*, post and telegraph office, hospital, and even a gaol, all built of sticks.

Planting.

Now I come to the great Planting enterprise, which began with coffee, and has been continued with tea.

Coffee was growing in Ceylon before the Portuguese came. We hear of it first in Yemen, and thence Arabs brought the shrub to the Malabar coast and to Ceylon. It is doubtful whether in its Arabian home or anywhere else the use of the coffee-berry as a stimulating drink was

known before the beginning of the fourteenth century. The Sinhalese seem merely to have used its leaves in curries, and strewed the white, perfumed blossoms in their temples. The Dutch found coffee growing when they came, and began to ship small quantities, but the export was never large, and about 1741 it was allowed to decline, Java yielding as much as they cared to throw on the European market. But the Sinhalese had learned its value, and they cultivated a little. After we came small quantities were collected by the Moormen, and brought to Colombo and Galle. Soon after we annexed the Kandyan country coffee began to attract the attention of some of our countrymen who had capital to invest, and in 1824 the first European coffee-estate was opened in the lower hills. About 1837-40 there was a great rush into coffee. The Government sold large tracts of forest to the planters, and the enterprise grew and prospered, though not without its vicissitudes. Mistakes were made sometimes, and capital sunk irrecoverably, in the opening of unsuitable land. There were districts of which it was said that they were like Westminster Abbey—"the grave of many a British sovereign." But in the main the planting did well, and the clearings climbed higher and higher up the mountains. Very many of the planters were hard-working Scotchmen, and numbers of the estates bear the names of towns or properties in Scotland. I believe that a large number of these pioneers of planting hailed from the neighbourhood of Aberdeen and Elgin. The railway up into the mountains, begun in the sixties, and afterwards extended, materially aided the enterprise.

Sinhalese villagers, who are expert axemen, cleared the jungle, but did not care to engage in permanent coolie work, and the supply of coolie labour was drawn from the Tamil districts of South India. Without this singularly convenient labour supply, cheap, docile, and ready to hand, the enterprise could never have succeeded as it did.

About 1873 coffee-planting attained its zenith. The yield was generous, and prices ruled high. Then followed a period of unnatural inflation. It sometimes happens, that when a useful industrial or commercial enterprise has prospered signally, an over-speculative spirit makes its appearance. So in Ceylon, a gambling speculative element engrafted itself on the enterprise of the hard-working *bonâ fide* planters. Then disease attacked the bushes, and the artificial inflation rendered the downfall all the more disastrous. About 1879 the fall was headlong. In 1882 the export had fallen from over 1,000,000 cwt. to about a quarter of that quantity. The planters and their creditors were at their wits' end. Estates were sold for a mere song. Owners and mortgagees lost their money, superintendents their salaries, and even coolies at eightpence and ninepence a day lost arrears of wages. There were estates on which (excepting weekly advances of rice for food) the coolies' wages had not been settled up for a couple of years.

Yet the mass of the planters never lost heart. Liberian coffee was tried without much success. Cinchona prospered for a while, saving many from sinking. Then disease and a fall in the price of quinine attacked that product.

Even then the planters were not to be beaten. They turned their

attention to tea. They had to cut out dead or dying coffee, plant up the land anew, and wait for crop. They had to provide an entirely new class of expensive machinery; and they had to learn, and to teach their employés, a new industry.

All this was successfully accomplished, and now for many years the tea has been thriving and paying handsomely, not only in the old coffee districts, but in new ones, some of them in the low country.

Success has seldom been better deserved. This recovery was a marvellous achievement—a success won in the face of obstacles apparently insurmountable, by stubborn perseverance, combined with alert and adroit enterprise in installing a new industry, and aided by the cordial and resolute manner in which the planters made common cause and worked together.

Sinhalese villagers now come in and take coolie work on the low country estates; but their labour is more intermittent, and therefore less valuable, than that of the Indian coolie.

There are now more than 300,000 acres of land under tea, and the annual export has reached close on 100,000,000 lbs. Teas grown high up in the mountains fetch the highest prices, but the low-country estates give most leaf: thus, between the two, the question, Which pays best? is a problem in *maxima* and *minima*.

Cacao thrives and pays within a limited area in the lower hills; and quite lately coffee, which was becoming forgotten, has had somewhat of a revival.

It is unlikely that the acreage under planting can be much further extended, for want of suitable and purchaseable forest land to plant. Ceylon planters are now overflowing into Nyassaland and the Straits Settlements.

Tea, so far, has been a persistent success in Ceylon. The question is sometimes mooted—and of course it is an important one—whether this success is likely to be permanent, or whether tea may one day fail as coffee failed. Experts acquainted with tea in China and Japan have been heard to predict a falling off in the yield at the end of about thirty years. The horizon is not without presage of difficulty in the way of labour supply, and of wood fuel for the coolies and the apparatus; but so far there have been absolutely no signs of any diminution in the yield. It may be that the poor soil and forcing climate are better suited to a leaf product than to a berry, such as coffee.

Excellent as this planting success has been, its value, so far as the native inhabitants of the island are concerned, may be, and often is, overrated. It has raised the administration to a high financial scale, and has provided employment for some of the native inhabitants, fewer however than is generally supposed. The bulk of the returns go elsewhere—the planters' well-earned profit to Europe, and most of the wages expenditure to the Indian coolie. I do not undervalue the planting; on the contrary, I value it highly, only it is not correct to say that the interest of the planter is necessarily that of the sons of the soil.

Food Supply and Health.

There are districts in which the people have been straitened for food,

such as the Wanny, towards the north-east; but for the reasons already mentioned, it is unlikely—perhaps impossible—that Ceylon should ever experience those extensive failures of rain which have produced famine in India.

The opening up of the country has been a powerful agent in favour of public health. As to European health, the contrast between now and eighty or ninety years ago is marvellous. It is curious to compare the conditions under which our troops now undertake tropical expeditions, with what our men underwent in those early Ceylon days, not from the enemy, but from disease. Ill fed, ill clothed, exposed to tropical sun and tropical rain, the wonder is that any survived at all. In 1817 the loss from disease was twenty per cent. One detachment of 250 lost 200 men from fever in three months.

Conclusion.

I fear I have already detained you too long, yet I should like to add a few words in conclusion.

There is no need to insist on the value of Ceylon to Great Britain at this day. Its situation and its harbours are invaluable to us—close to India and on the high road to the Far East and our Australian colonies. The possession of Ceylon is indispensable to our Indian Empire, and her harbours, Colombo especially, are of the utmost value in relation to other parts of the world. And then there is the planting, and the great commercial success, the great import and export trade which has developed under our rule.

And how far has our rule proved a boon or otherwise to the native inhabitants, the sons of the soil? Doubtless, if we had not taken the country when we did, some other foreign Power would have had it; and without vanity we may believe that the people are better off with us than they would have been under any other Power. I am sure that no Power governs its subject races with such humane and disinterested intentions as Great Britain.

The question, how far our administration has been really successful in promoting the welfare of the people, is not one to be answered in a few cheap phrases about the blessings of British civilisation. Nor is the commercial success of our government necessarily a correct measure of its value to them. Side by side with all that we have done, three unhappy mischiefs have grown up in the country—Drinking, Gambling, and False Litigation. Our Government has been sincerely wishful to benefit the native races. Its shortcomings have been unintentional, due to lack of touch with the people, and insufficient knowledge of their needs.

I have mentioned certain matters in which our wheels revolve awry. It is unfortunate that the native languages are too little used in public business—far less than in India. In the law courts, for instance, everything takes place in the English language. The mischief of this is twofold. The people, much to their disadvantage, are left in the hands of intermediaries, Eurasian or other, and the administration, being less in contact with them, is the less alive to their needs.

Our shortcomings have been greatest where most of you would least expect to find them—in the administration of justice. The people believe, and rightly, in our will to do justice without fear or favour. In the criminal courts native prisoners continually entreat to be tried by English gentlemen. The failure is, because our legal machinery is not adjusted to the country. When the law fails to do justice, crime increases. I have known cases in which an influential man has oppressed the people round him, in defiance of law, till at last in despair they murdered him; and that not in remote, wild parts of the country, but quite the contrary. The law needs to be simpler and cheaper, and justice more accessible.

Lord Roberts, writing of the Indian administration, has set down with his keen insight, and in his terse and lucid manner, much that the Ceylon Government might well take to heart.

It is a very difficult task to contrive laws and institutions for an Eastern population; and there is a strong and plausible temptation to cut the knot by borrowing something from our own country, which may be, after all, unfitted for transplanting. Thus trial by jury was introduced in criminal trials—an excellent thing in our own country, where it was born of our national character, but disastrous in Ceylon, where it simply means injustice. The European and the native press agree in desiring to be rid of it, as unsuited to the country.

Excellent as our rule is in many ways, the very strength of our Executive, coupled as it is with so much miscarriage of justice, creates for the people a horror which did not exist in the less orderly days before we came, viz., injustice by the strong arm of the law when misdirected. For now no native, however blameless his life, can reckon himself as secure from the success of some false and malicious criminal accusation.

But I hope we may take courage. Having achieved so much in other departments, it is possible for us to succeed in this also. I dwell on these shortcomings, not in any way as a pessimist, but because, while our successes need no advertisement, mistakes need to be pointed out in order that they may be remedied. The success in some departments has been so great that there is risk of its overshadowing departments which are less successful, and distracting attention from what remains to be achieved. I gladly recognise that late years have witnessed improvement, and hope that it may be further extended.

THE BRITISH IN SOUTH AMERICA.

By Col. Sir Howard Vincent, C.B., M.P.

(Read at a Meeting of the Society in Edinburgh, March 11th.)

It is with some trepidation that I appear before the Royal Scottish Geographical Society, and more especially after the great triumphs attending its welcome last month to that intrepid maker of geography—the Norwegian "Scotchman"—Dr. Nansen. Be assured that the honour is not of my seeking. To the invitation of the Committee I replied that, although the good fortune had been mine to visit wellnigh every people and every country on the face of the globe, to see the wonders of the world, and to become acquainted with most of the leading passengers thereon of this generation, no discovery ever fell to my share, and, indeed, even amid war and revolution, scarcely an adventure. But still your Secretary pressed. The subject chosen by the Committee is "The British in South America," and happily there is to be a discussion, from which I hope to learn much.

Fortunately the aims of the Society include the study of geography in its relation to international commerce. Connected with international trade by representation of Sheffield, and by that tie alone, commercial geography was the main object of my visit to the Republics of South America. Fertile land, indeed, for the growth of commercial fruit, and one in which the British, and especially those north of the Tweed, have sown with all the discriminating ability of the race. This quality, coupled with adventure and probity, has done more than aught else for the extension and settlement of the British Empire.

History tells of the decline and fall of the great Empires of Greece and of Rome, of the decadence of Holland and of Portugal. But assuredly there is nothing more melancholy to contemplate than the decline and fall of Spain. To think that Spain, to-day almost vainly struggling to retain the last of her over-sea possessions—Cuba and the Philippines—discovered and settled the wondrous continent of the New World, and held unchallenged sway for over two centuries in Central and South America, the seat now of seventeen or eighteen independent republics! How are the mighty fallen! A lesson indeed to be taken to heart by us, the heirs to-day of the imperial ascendency of the empires of the past.

But in all the work of the British in South America, there is to my mind one great and conspicuous landmark. It is a record of the valour and devotion of Scotchmen, of shame and disaster to the Union Jack. It is a page of history on which most British historians are silent. There are few, I expect, even of the Royal Scottish Geographical Society, who remember how the Highland Light Infantry, but ninety years ago, captured the capital of the fairest country in South America, how the regiment had to capitulate, to surrender its standards, still hanging within the walls of a Roman Catholic church in Buenos Ayres, and how the relieving force, shamefully led, was ignominiously defeated and expelled.

In its proper place we may well take count this evening of that extraordinary episode. But for the present I bring it before you as the great effort of the master mind of Pitt to recoup to the British flag the loss of the United States of America, and a raid, in this day of raids, which would, if successful, have altered the whole course of South American history. The closer proximity and greater natural wealth of the continent would have probably turned us from the more arduous, yet successfully accomplished, task in Australia.

Venezuela.

In close connection with this effort of the British to establish a foothold in South America was the Venezuelan General, Miranda. It was he who put the idea into the mind of Mr. Pitt. With Venezuela, therefore, we may well commence our survey of South America this afternoon, and not the less as that Republic has taken so conspicuous a part of late in the relations between the two peoples of the Anglo-Saxon race. At one time it looked as if the petty animosity towards this country of the Venezuelan Government would bring about a great fratricidal war. Happily, this was averted by the coolness and common-sense of Lord Salisbury, well seconded by the dignified attitude of the people behind him.

For ten years now diplomatic relations have been interrupted between this country and Venezuela. On February 20, 1887, the British Minister at Caracas received this note : " Great Britain has progressively increased her advance from the Essequibo to the Pomaron, the Waini, the Barima, and the Amacura. Great Britain has therefore violated the rights of sovereignty and the independence of Venezuela. Venezuela must not preserve relations of friendship with a nation which has thus offended her, and, in consequence, suspends them from this day."

You will not expect me to enter upon an elaborate argument as to the merits of the British case. Suffice it to say, that I believe it to rest upon a sure and equitable foundation. The frontiers of British Guiana, as acquired in 1814 from the Dutch, themselves heirs of the Spaniards, were surveyed in 1841 by Sir Robert Schomburgk, and these rivers lie well within them. But what galls Venezuela most of all is that the British cannot view with satisfaction the curtailment by the Republic of navigation on the great river Orinoco. This river yields the prize for magnitude to the Amazon alone, starting twelve hundred miles inland from the eastern slopes of the Peruvian Andes, flowing through untapped regions abounding with indiarubber and other precious products, and fed by 436 tributaries, until it empties itself into the South Atlantic through a mouth the width of the English Channel at Dover. A century ago, the British affirmed the freedom of their flag on the Orinoco. It was re-affirmed by Lord Rosebery in 1886. But the last Consular report laid before Parliament says that " The navigation of the great waterway of the Orinoco is a monopoly held by a company possessing but two steamers, resulting in a general paralysation of business on the river, and in the abandonment of numerous villages on its banks."

But if there is much that is deplorable in the attitude of Venezuela in

her relations to international commerce, there is some consolation in the beauty of her northern territory. If her statesmen are impetuous, and her people are hot-headed, the fault does not lie with the climate of Caracas. It is the finest in the whole world. The mean temperature all the year round is 60° by day and 57° by night. If, moreover, there is any unlooked-for deviation, compensation is found in a delicious breeze at an altitude of 4000 feet, with the most delightful mountain excursions close at hand.

The port of Caracas is La Guaira—British-made and British-owned, with one-third of its shipping British. Thence a wonderful British railway ascends to the capital. One-third of its goods traffic consists of imports from Great Britain, and the proportion would be still larger but for the thirty per cent. additional duty charged since 1882 upon all imports from the British Colony of Trinidad, in defiance of the Treaty of 1825 and the Commercial Engagement of 1834, maintained despite the protests of Her Majesty's Government. The excuse for the imposition was in the allegation that Venezuela was subjected to a heavy contraband traffic at the hands of Trinidad—distant but the space of the Dragon's Mouth from her shore—a traffic, it need not be said, very easy to hinder if it existed at all, if its point of departure and point of arrival were so well known.

British Guiana.

A contrast indeed is the administration of British Guiana to that of its two neighbours—Venezuela and Brazil. Almost the size of the United Kingdom, British Guiana, although greatly affected by the depression in the sugar industry, which is working such havoc in the West Indies, does a trade of £4,000,000 a year, of which about one-half is with the United Kingdom. The population is about 55,000, among whom Dutch laws still largely obtain, in accordance with the Treaty of 1814, which finally transferred Guiana from the Dutch, who had held it since 1580.

Brazil.

Brazil is Portuguese rather than Spanish. It was discovered in 1500 by Pedro Alvarez Cabral. Its area is nearly equal to that of Europe, and is twenty-seven times the size of the United Kingdom—and one province, Amazonas, is four times the size of France. Yet all the twenty States have only a population of about seventeen millions. The coastline extends over 4000 miles, with forty-two ports, of which Rio de Janeiro is at once the largest, with a circumference of 123 miles, and with only one rival for beauty in the world, namely, that of Sydney. The great products of Brazil are indiarubber, cocoa, sugar-cane, and coffee, of which last alone seven million bags were exported in 1895, valued at £28,000,000. The National Debt at the present rate of exchange exceeds £113,000,000 sterling, to which the State debts add considerably. Both are largely held in Great Britain, and, with British investments in Brazilian railways, the financial interest of the United Kingdom in Brazil is calculated largely to exceed £100,000,000. It must be admitted that the

Republic, following in the footsteps of the Empire, shows a praiseworthy desire to meet its foreign engagements honourably and honestly. If only the country remains quiet, there is no reason why this should not be done, for only the very fringe of its resources has as yet been tapped. But the great danger lies in revolution—that curse of South America. On November 15, 1889, the Empire fell, and the venerable Emperor, Don Pedro, who held this classic city in such high esteem, surrendered to a couple of battalions, and next day left the country for ever. Since then, revolution and martial laws have testified to the National motto of "Order and Progress." I went to Rio to see the great naval revolution in 1893. The insurgents, under the leading Admiral, seized the navy, and for months held the harbour against the President and the army on land. There were numerous representations of bombardment. The people came out to see each one as they would a theatrical performance. Good places on the heights were let for a considerable sum, and, if the programme announced was not carried out, the audible dissatisfaction was great. A great deal of powder was burnt, an immense quantity of shot and shell was fired into the water. But, in proportion to the length of time the melancholy exhibition lasted, the loss of life and the damage done were infinitesimal.

Uruguay.

The entrance to the River Plate, if not picturesque, is magnificent in its vastness. The idea of a river is wholly absent. The waters are murky, and often turbulent. Both goods and passengers are frequently landed under difficult circumstances. To the right as you enter lies the republic of Uruguay, with its picturesque capital of Monte Video, now, as often, in a state of siege. Some fourteen miles across on the other side of the river is

Argentina.

The distance deprives Uruguay of any power of commanding the mouth of the Plate. This is fortunate, as between sister republics there is as much jealousy as between political parties. Moreover, Monte Video has no port. It was opposite Monte Video on the 10th of June 1806 that Captain Sir Home Popham gave orders to the three frigates, three corvettes, and five transports he had brought from the Cape of Good Hope, to anchor. On board were the 71st Highlanders and a battalion of Royal Marines. A few days later they sailed up the river towards Buenos Ayres, and landed 1550 strong under General William Carr Beresford. The Highland Light Infantry led the way, as on many another field. The Spanish Viceroy had fled betimes with all the treasure he could collect. The Highland skirmishers opened fire, and the Argentine horse and foot laid down their arms. A brilliant expedition indeed. Argentina was British. A million of silver was despatched to London with the good news, and a request for reinforcements. They were quickly organised. A force was being prepared for the invasion of Chile under General Craufurd. Its destination was changed, and 12,000 men in four brigades, commanded by Craufurd, Auchmuty, Lumley, and Mahon,

were sent to complete the conquest, under Lieutenant-General John Whitelocke. An evil choice indeed. With 110 British sail the force left Falmouth on October 11, 1806. It was May 1807 before the army was massed on the River Plate. Monte Video fell to Sir Samuel Auchmuty. But what did the British learn of the 71st? The small numbers who had achieved the triumph made a deep impression on the Argentines. There were a few hundred Highlanders in the midst of tens of thousands. Beresford was ill-seconded by Popham, jealous of his success. The kindly rule of the British commander obtained no grateful response. Internal difficulties broke out. The organisation of a Spanish force at Monte Video, under one Liniers, gave courage to the inhabitants. Popham allowed it to land on August 11th with 4000 men. For this he was brought to trial. The Highland citadel was besieged. The Highlanders held good, but their ammunition gave out. They had to surrender, and their standards in gold cases are the proudest monuments to-day of the Church of San Domingo. I have here pictures of them. Thus, even while London was rejoicing, the Scottish conquerors were being marched as prisoners up the country—their ears, some say, being cut off for cockades. How were they avenged by Whitelocke? For him the attractions of Monte Video were great. He tarried for two months, while the Spaniards were preparing for his reception. On June 28, 1807, he disembarked his forces thirty-six miles from the capital. The Highland brigade under Craufurd led the van for the relief of the 71st. It carried all before it. Had it pushed on without halting, once again Buenos Ayres would have been ours. But Whitelocke's orders were imperative to wait for the main body. Three days elapsed. At length, on July 5, Whitelocke was ready. Even so the Argentines. At first the fortune of the day was with the British. On the east, the south, and the north, the Union Jack was run up. But by two o'clock Craufurd was surrounded. With 46 officers and 600 men he had to surrender. By sunset the British had 1000 dead and had lost 1000 prisoners. A proposal was made to them to evacuate the country. It was refused. The next day the British again advanced. They entered the narrow streets, and from roofs and windows death rained on them. Then came a flag of truce from Whitelocke, and in two months the British complied with the Argentine demand. The final scene was on January 28, 1808, in the great hall of Chelsea Hospital. Nineteen generals, including Sir John Moore, formed the court-martial of which I hold the proceedings in my hand. On the 18th of March it adjudged "the said Lieutenant-General John Whitelocke to be cashiered and to be declared totally unfit and unworthy to serve his Majesty in any military capacity whatever." This sentence was approved by the King, who directed it to be read at the head of every regiment as "a lasting memorial of the fatal consequences to which officers expose themselves, who, in the discharge of the important duties confided to them, are deficient in that zeal, judgment, and personal exertion which their sovereign and their country have a right to expect." For many years afterwards a favourite toast was "Honourable grey hairs but no White Locks.' So mote it be! But if the capture of Argentina by the Highland

Light Infantry was thus rendered null and void, the British have now none the less planted themselves on the fertile soil of the Republic.

Two hundred millions sterling, at the very least, have they laid out in Argentina. They have advanced millions to the Government, millions to the States. They have laid out millions in railways, millions in land. Many of these millions they will never see again. Many might as well have been thrown into the sea. But the people of the Republic have been great gainers, and the heirs of the millions will reap a reward.

There is nothing perhaps more remarkable than the change which is rapidly coming over the proprietorship of the soil. The British population is not more than 40,000. The French are more than twice as numerous. The Germans also. The Italians surpass us numerically twentyfold. They are the workers. Many come in the swift Genoese steamers, their own harvest finished, to gather in a second, and then they return home again, their pockets full of paper. But the great tracts of land are in British hands, and the vast estates of the Argentines are being rapidly broken up, and transferred to foreigners. These foreigners and their children equal, if they do not surpass, in numbers the Argentine population. But in the hands of the latter only is the political power. It is frequently varied by revolution—sounding portentous in cablegram, but meaning little. Political traitors cannot be executed, and are usually pardoned. Therefore agitators make revolution with light hearts. Albeit Argentina possesses many highly capable leaders, but a small proportion of them unfortunately enter the political arena. A time will doubtless come when, as elsewhere, the government by the minority to the prejudice of the British will have to be faced. The lessons of other lands should convey their warning. If taken to heart, there is no limit to the expansion and development of Argentina. In area it is ten times the size of the United Kingdom. Its population is less than that of London. Of this, a third—over three-quarters of a million—are in and around Buenos Ayres—a delightful city, bright and gay, a home of commerce and of fashion too. The names of its magnificent squares, of its thronged streets, ablaze with light, filled with dazzling equipages, may recall the triumph over the British in 1807. They may speak of Vittoria and Reconquista, but the victory has been that of Europe, and the reconquest the triumph of the luxury of the Old World.

Three years ago there died, at the age of ninety-two, a typical old Englishman—Sir Harry Verney. Seventy years ago he travelled in the Argentine. He made for the Andes as we did. But our conveyance was a special train, his the wild horse. The posts to the Chilian frontier were thirty miles apart, and dangerous posts they were. Indians were on all sides. A relay was wanted. Gauchos were sent out to round up a *tropa* of horses. They were driven into the *corral*. Those required were selected. The horse was blinded by a *poncho* thrown over his head. The horseman strapped on the saddle, forced the bit into the mouth, jumped up, and as he did so pulled away the *poncho* with the left hand. The journey finished, the horse was let loose again on the *camp* to find his comrades. It took fourteen days to cover the six or seven hundred miles to Mendoza.

The Cordillera.

From that beautiful town of shaded avenue and the vine starts the Trans-Andine railway. If Argentina is in the main flat as a pancake, if the Central Argentine has neither tunnel nor cutting throughout its system, from Mendoza the change is great. Thence begins the passage of the Cordillera. For a man it is nothing: for a woman it is serious. There are comparatively few who attempt it. Those who are in the Argentine take their holidays Europe-wards. The foreigners in Chile wisely think the Straits of Magellan and a comfortable steamer far preferable. The first hundred miles towards the Andes from Mendoza take the traveller up 7000 feet to Puente de Las Vacas—the resting-places of the herds driven in the summer over the Andes to feed the Chilians.

Thence there is now a coach and a coach road to Las Cuevas—the base of the summit. But we had to ride on mule-back from Puente de Las Vacas. The Cumbré or summit is twenty-five miles away, It must be crossed before noon, for as a rule a gale springs up soon afterwards—dangerous to man and beast threading a narrow path overhanging precipices five miles deep. But the first seven hours on the upward grade are comparatively easy. Then from Las Cuevas begins the struggle. The Cumbré is in front of you. There is just room for the mule. Trust to him you must. Look straight ahead and hope it may be well. You are already 14,000 feet up, and understand why the mask and the veil are essential to a lady. The rarefied atmosphere would strip the skin from her face. There is not a living thing to be seen—no birds, no trees. Distances are nothing. That mountain—the peak of Tupungato—twenty miles distant, does not appear to be two away. But once at the top of the Cumbré, what a glorious sight—worth all the danger, all the fatigue.

The ascent is bad, but nothing compared to the descent into Chile, as my wife and I found it in early spring—the path often hidden by deep snow. It has been improved of late. Coming up from Argentina is not nearly so trying to the nerves as going down into Chile. A stumble—and then? But all is well that ends well; and when you reach Juncal, and still further the Soldier's Leap and Los Andes, you forget all that is past in smiling, picturesque Chile. How long will yet elapse before the railway is completed? It is making but slow progress. From the Argentine side and from the Chilian the English are approaching each other. But the Cumbré is the difficulty. Mr. Baggallay, Messrs. Clark, and other engineers will not be daunted. They will pierce that solid mountain of rock with a shaftless tunnel seven miles long. Money, though, is lacking. It is an enterprise beyond the ordinary investor. State guarantee is essential, and from both sides the problem is viewed somewhat with the feelings in Southern Britain regarding the projected Channel tunnel. The Chilians have most to gain. They are farther from Europe. They want the produce of the pampa for their hardy mountain race. But it is bellicose as well as hardy—fierce in battle, proficient in arms. And maybe, with frequent questions surging between them, the prosperous Argentine basking in the sun may feel that it is well to keep a mountain

of rock between himself and armed danger. The disputes are many. Within recent months there has been fresh question of war. Argentine and Chilian are both enriching the Tyne and the Clyde with their orders for warlike material. Happily now the matters at issue have been referred to the arbitration of Queen Victoria. May the result be as beneficent as all to which Her Majesty's royal hand and countenance have been set these sixty years of unexampled rule.

Chile.

Of all the peoples of South America the Chilian appeals to British sympathy most warmly. The Chilians are the British of the Pacific. They have our qualities, tempered by their sublime climate. Britons have settled among them and become Chilians. Who are their leaders to-day? Men whose surnames are as familiar in Edinburgh as in Valparaiso and Santiago. Maciver and Ross, Edwards and Walker,—worthy successors indeed of Cochrane and Mackenna. Yes; this Scotland of South America is indeed a land worthy of the name. Its laborious Government, its unpaid legislature, its patriotic administration, its municipalities, its honesty, its energy, its vigour, its morality, stand high above any of their continental rivals. The capital, Santiago de Chile, is one of the most beautifully placed, most attractive towns in the world. In Valparaiso the greatest houses are British; nearly half the shipping is British. There is British representation and British common-sense in the Municipal Council. Nevertheless, the German has come with a rush to dispute our sway. In mere numbers he is already slightly ahead, and especially in the lower ranks of commerce. The German clerk laughs in his sleeve as he sees his British rival surpass himself each day in the sporting character of his costume, sees him more occupied with the racing merits of this or that pony than with business—laughs in his sleeve as early morning trials make him later and later at the office, when lawn tennis and golf call him away at the stroke of four, while the phlegmatic German earns the eulogy of his employer, steadily plodding on for a moderate wage.

Nevertheless, it is undeniable that if the young Briton in a foreign land —in China as much as in South America—has a good time of it, and finds many ways of spending a liberal salary right royally, he puts his shoulder most effectually to the wheel when serious and big work has to be done. This accounts for the great enterprises being almost entirely in British hands—the principal railways, the ports, the large estates, the main factories. Thus it is that Britain for a time transformed the Rainless Coast into a mine of gold. The courage, the energy, the resource of the late Colonel North stand out conspicuous. The nitrate beds were the greatest heritage of Peru. The wealth they brought in was attended by a feeling of superiority. The Chilians had been quietly preparing, and when war came their organised forces speedily negatived Peruvian valour. The nitrate fields were the first prize, and a splendid revenue they have ever since brought in. The export of nitrate in 1895 was 1,200,000 tons, valued at £7,200,000, of which £2, 12s. 6d.

per ton, or 100 per cent., is in respect of the export duty. The only misfortune connected with the industry has been that over-capitalisation which is caused by the greed of investors. On a reasonable sum the many mills would have given a fair annual return. But, when many hundreds of thousands were paid for properties not worth as many tens, it is only natural that disappointment should ensue.

In many cases, too, the *caliche*, whence the nitrate of soda is extracted by boiling, is becoming exhausted. New fields close at hand are not easy to find, and, if at any distance, the moving of the machinery presents serious obstacles.

Peru.

As the vessel steams northwards along the sandy waste of the rainless coast—a journey broken only by the stoppages at numerous ports, dependent on the stores and cattle we bring for sustenance—the passage from Chilian into Peruvian waters becomes at once apparent. It is made manifest by the more leisurely arrival of the port officer, by his *dégagé* air, by the lassitude of his oarsmen, and by a tendency to raise imaginary difficulties in the grant of pratique to the ship, until Worcestershire sauce, or other fancy he may have, is gratified.

Yet, withal, the Peruvian is brave and courteous, his accent is the purest Castilian, and the beauty of the ladies' eyes recalls the fairest types of the ancient race which colonised the New World. In Peru the Spaniards found the Empire of the Incas, or Children of the Sun. Far in advance of their time do these appear to have been. Many are the monuments still of their industry and science, of their prudence and sagacity. They were prosperous in peace and victorious in war. Tarapaca was the first fruit of the Chilian victories in 1880 over Peru. Nor are the provinces of Tacna and Arica yet evacuated. The indemnity to be paid by Peru prior to the taking of the vote of the inhabitants has not been, and is not likely to be, discharged.

Peru has four times the area of the United Kingdom, with under three million inhabitants. Half of the shipping at the great port of Callao is British, and the Chilians come next, whose officers are nearly all British. Thence to Lima is but a few miles. There the want of rain is met by an almost constant morning mist.

Of the many ventures in Peru of the British, the greatest is that of the Peruvian Corporation. It took over the £50,000,000 of external debt contracted by Peru, as also ten State railways, largely built from the contractor's point of view. The Corporation has had many difficulties to contend with, and not the least the non-payment by the Government of the £80,000 a year guaranteed from the customs receipts, added to very numerous revolutions.

But if the possession of a wonderful line of railway is a valuable asset, that assuredly is the privilege of the Peruvian Corporation. I have seen all the triumphs of engineering, but never a greater than that carried to a successful issue on the Oroya railroad. It passes 120 miles through mountains by fifty-seven tunnels; it crosses torrents by marvellous bridges; it skirts precipices; it leaps yawning chasms until the summit

is reached of 16,000 feet, and all the accompanying pains and sickness of the *soroché*. Let me take a passage from Lady Vincent's last book, *China to Peru, Over the Andes*, written on the way up to Monte Meggs:—"Five lines of railway are visible. There is first the rail we are on, then there are three in successive rows beneath, cut out in V-shaped gashes on the mountain side, whilst the remaining line is espied far below on the other side of the Rimac, which we had crossed on a low bridge."

The project has always been to carry the railway on until it touches the valley of the Amazon. But whether or no this can be accomplished in our time is more than doubtful. With so much in Peru that might make for prosperity, the appearances on every side are those of adversity —for which the wrangles of rival politicians are greatly to blame.

Bolivia, Ecuador, and Panama.

I wish it were possible to take you to Bolivia across the wide expanse of Lake Titicaca. But our journey's end must be soon. Undoubtedly Bolivia offers some commercial attraction. But it is coupled by extreme difficulty of access. In Bolivia, as in Venezuela, the British are unrepresented. It is said, I know not with how much truth, that the Consulate was withdrawn after a holder thereof had been led out of the capital, seated on a donkey, with his face towards the tail.

Nor can we tarry in Ecuador. Guayaquil, the seaport, is a flourishing town in many respects, but a very nursery for Yellow Jack. It is to be hoped that the fire which of late nearly burnt down the commercial quarter may cause it to be rebuilt under better conditions. Yet the trade of Guayaquil is prosperous, and thence goes to France and Spain the finest cocoa in vast quantity.

Our final glance must be at the Panama canal. I stand before you a firm believer in it—the possibility of its accomplishment and the good it will do. In 1836 the British Government directed the attention of British merchants in Peru and Chile to the importance of establishing communication with Europe *viâ* Panama. These merchants assembled in meeting at Lima and Valparaiso and expressed "respectful gratitude for such an unequivocal proof of the anxiety of His Majesty's government to promote by every proper means the commercial interests of Great Britain, and unanimously concurred in the almost incalculable advantages and benefits likely to accrue from the establishment of the projected intercourse *viâ* Panama."

The Pacific Steam Navigation Company's service from the Bay of Panama to Valparaiso was an early result. Then in 1849 American contractors laid a railway across the Isthmus. It was in 1876 that the United States of Colombia granted the concession for the canal, and in 1879 it was transferred to M. Ferdinand de Lesseps—*un grand Français*, despite the terrible misfortunes of his later years. About £53,000,000 of French savings have been laid out on the canal. About twenty-one kilomètres, or not quite one-third of the whole, were finished when the difficulties of the Chagres River and the Culebra mountain proved insuperable. Two years ago the official liquidators organised a fresh company

to recommence the work. An independent witness wrote to me last December :—

"At Culebra some progress has been made with a course of from ten to twelve feet over its entire width. Work is being carried on over the entire length. On the Pacific side wharves are being built so that all steamers may come alongside. More is being done now in a quiet way than ever before, and without that retinue of officials which proved so disastrous to the projectors."

At least £40,000,000 will, however, be necessary to complete the canal. But how this is to be obtained I cannot conceive, without enlisting the help of other nations. But if France succeeds in carrying out this great work the world will rejoice. The voyage from Liverpool to San Francisco would be reduced by 15,000 miles. Four thousand miles would be saved between Plymouth and Peru. It would give us a new route from the Clyde to China and the Far East.

With this hope for the future I may be permitted to conclude. I am very sensible that my address is by no means worthy of the Royal Scottish Geographical Society. But if it can do anything, however little, to direct the attention of Scotchmen to the great importance to Britain of South America, and to impress on the members of the Society its value and practical uses in connection with international commerce, the hearty thanks I give you for your kindly attention will not be, gentlemen, any mere form of words.

After the lecture, the Chairman, Mr. James Currie, invited Mr. John Wilson to address the meeting. The speaker called attention to the fact that, though more than £50,000 had been disbursed by the shareholders of the Panama Canal Company, the part of the work already executed had not actually cost anything like that sum, a very large proportion of the capital having been unlawfully diverted into other channels, as was revealed by the legal proceedings in Paris. Nevertheless, it was no doubt a very costly undertaking, especially owing to the difficulties connected with the Rio Chagres, which was subject to sudden spates, rising as much as thirty feet in a few hours. It would, therefore, be advisable to compare the Panama scheme with another that had been much discussed of late—the Nicaragua Canal. The United States Commission had, more than twelve months ago, issued a report on the scheme, in which, it was said, an unfavourable opinion was expressed. Mr. Wilson had not seen this report, nor did he think it could be generally known in Great Britain, for the Edinburgh Chamber of Commerce had been unable to procure a copy of it without sending direct to Washington for one.

Major Stanley Paterson, who has recently been up the Orinoco, stated that he had there come into contact with the promoters of a Company—British subjects and Americans—which had been formed to develop the resources of the upper reaches of the river, to collect indiarubber, to prospect for minerals, and to carry down the river to Trinidad the goods that at present found their way on mules by a long and difficult land journey to Bogota, or along the Cassiquiare into the Amazons basin. In answer to a question by the Chairman, Major Paterson replied that there was no monopoly of navigation on the Orinoco granted by the Venezuelan Government, except for the Macareo and Manamo mouths. The depth of these channels was about twelve feet. The Boca Grande, the principal mouth of

the river, was obstructed by a bar, though there was a passage beside Barima Point. As for the Mora passage, which, connecting the Waini and Barima rivers, affords access to the Orinoco behind the bar, Major Paterson could not give its depth, but he knew that large vessels could enter the river by this route.

The Rev. Lyall Wilson, having travelled through the Argentine Republic from north to south, and from east to west, could bear testimony to the enormous natural resources of the country. He had also crossed the Andes into Chile, at about the same time as Sir Howard Vincent, and there, as well as in Argentina, Uruguay, and Paraguay, he had noticed how large a share was taken by British subjects in the work of developing the country, and introducing the arts of civilisation.

Mr. Hope Gibson said it was too late to speak at large on Argentina. There was only one remark in the lecture that he desired to comment on, and that was, that many of the millions advanced to the Argentine Republic would never be repaid to the lenders. Speaking as an Argentine, he affirmed most emphatically that these debts would never be repudiated. The Republic had been in financial difficulties before, and had honestly faced their liabilities; and, though there might be some loss of interest, the present debts would be faithfully discharged.

A vote of thanks having been proposed by the Chairman, Sir Howard Vincent congratulated himself on having elicited so much information from the gentlemen who had taken part in the discussion. With reference to the Nicaragua Canal project, he believed that the Rio San Juan presented quite as great difficulties as the Chagres. Then, again, on the Pacific slope there was a deficiency of water, while on the Atlantic side the harbour of Grey Town was very shallow, and expensive dredging operations must be executed before ships could reach the mouth of the river. For the Argentines he had always entertained a great affection, which would be much increased by Mr. Hope Gibson's statement.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Election of Members.

At a meeting of Council held on March 15th, the following 140 ladies and gentlemen were elected Members of the Society :—

Booth, Mrs. Gore.
Boyd, Mrs. Stirling.
Brown, Miss H. Quinn.
Dyer, Mrs.
Ewing, Lady Orr.
Ferrier, Miss.
Forbes, Miss Alice.
Forbes, Miss Jane.
Gordon, Miss A. L. J.
Gray, Mrs. A. R.
Greig, Mrs. T. B.
Haig, Miss A. M.
Kinloch, Miss E.
Luis, Mrs. Ellen C.
Macduff, Mrs. E. A.
M'Phail, Miss Jane.
Mann, Miss.
Marwick, Mrs. I. E.
Menzies, Miss Jane.
Morison, Mrs. Miller.
Murray, Mrs. John.
Murray, Miss G. Graham.
Newman, Mrs. J. Hay.
Richards, Miss E. A.
Scoresby-Jackson, Miss A. M.
Skelton, Miss E. M.
Tod, Mrs. Wm.
Trayner, Mrs.
Turcan, Miss.
Walker, Mrs. D. D.

Williamson, Mrs. Wallace.
Ainslie, Thos.
Alexander, D. M.
Allan, Claud A.
Allan, J. E. Douglas.
Alston, J. R.
Anderson, A. P.
Balderston, Jas.
Balfour-Kinnear, J.
Barr, Alex.
Barr, Robt.
Baxter, E. G.
Bell, R. Fitzroy.
Benham, Ernest E.
Bickerstaff, Hugh.
Brown, F. Gordon.
Brown, Wm.
Buchanan, D. F.
Cameron, John, M.D.
Campbell, J. Adair.
Campbell, M. Pearce.
Cargill, Alex.
Cargill, J. Esplin.
Clark, Sir J. F., Bart.
Cleland, Prof. John, M.D.
Crombie, J. E., M.A.
Currie, Wm.
Dansken, John.
Darling, T. Brown, M.D.
Darling, Thos.
Davidson, Captain D. F.
Davidson, J. Stewart.
Deans, Duncan.
Dewar, Arthur.
Duncan, A. J., M.D.
Fairweather, W. W.
Finlay, J. Hope.
Finlayson, A. K.
Forsyth, Andrew.
Foulis, Jas., M.D.
Fulton, T. Wemyss, M.B., C.M.
Gemmill, J. L.
Gerstenberg, G. T.
Gibson, Henry.
Gibson, Wm.
Gibson, Wm., Jun.
Graham, J. H. N.
Gray, Alex.
Gray, D. Davidson.
Hagart, Robt.
Henderson, Alex.
Henderson, John.
Henderson, Robt.
Herbertson, J. R.
Hogarth, David.
Howatson, Chas.
Hunter, Jas. C.
Inglis, Geo.
Jackson, Wm.
Kennedy, Captain H. Shaw.
Lamb, C. W.
Lawson, Geo.
Lawson, Wm.
Low, The Hon. Lord.
Low, David.
Lowe, W. D.
M'Farlane, John.
M'Gillivray, A., M.B., C.M.
MacGillivray, Wm. A.
MacGregor, John.
Macindoe, Jas. B.
Mackenzie, Sir Allan, Bart.
Mackenzie, J. W.
Macleod, Rev. Donald, D.D.
Macleod, John M.
M'Neill, John.
Mathams, Rev. Walter.
Mechan, Arthur, M.B., C.M.
Meikle, Christopher.
Merrylees, Chas.
Moncrieff, D. Scott.
Morrison, T. Mackenzie, M.A.
Murdoch, T. Burn, M.D.
Murray, D. Hill.
Nicol, Geo.
Ottmann, H. B.
Pattullo, J. A.
Price, Chas. E.
Rattray, David.
Reid, John.
Reid, Prof. W. L., M.D., C.M.
Rennie, W. J. M.
Rollo, Geo.
Rush, H. M., B.A.
Saltoun, The Rt. Hon. Lord.
Scott, The Hon. Walter G., Master of Polwarth.
Shaw, Geo. M.
Simpson, J. Craig.
Smith, Wm.
Steven, Dr. P.
Stewart, J. G.
Stuart, Morton Gray.
Thomson, R. Whyte.

Tod, Wm.
Tuckwell, J. M.
Walker, Wm. N.
Wallace, John W.
Watson, David M.
Williamson, A.
Wilson, Jas., M.B., C.M.

It was resolved to present bronze medals to Captain Sverdrup of the *Fram* and Lieut. Johansen.

The following resolution was passed at the same meeting:—"The Council of the Royal Scottish Geographical Society record their deep regret at the death of Dr. W. Scott Dalgleish, who was intimately associated with the Society from its foundation. He served on the Council from the time of its first appointment, and as Chairman of the Education Committee rendered special service in the Society's schemes for the promotion of geographical teaching in schools. They recognise that in his death the Society has lost a valued friend and worker who was on all occasions active and ready to further its interests. The Council desire to express sympathy with his family in their bereavement, and instruct the Secretary to forward to them a copy of this minute."

Lectures delivered in March.

In Edinburgh two meetings were held during the month. On the 11th, Col. Sir C. E. Howard Vincent, C.B., M.P., read a paper entitled "The British in South America," Mr. James Currie presiding. On the 25th, Dr. Robert Bell, of the Canadian Geological Survey, addressed the members of the Society on "The Geographical Distribution of Forest Trees in Canada." In the absence of Professor Geikie the Chair was taken by Dr. Burgess.

On March 24th Dr. Bell lectured to the Glasgow Branch, Mr. Robert S. Allan presiding.

A lecture was given at Dundee on March 16th, by Dr. Zaytoun, his subject being "Cape Juby and the Sahara." Ex-Bailie Robertson presided.

The second set of lectures on "The Unity of the Empire" was delivered in Edinburgh by Prof. Prothero.

Lectures in April.

Professor Prothero will sum up the results of the facts and principles set forth in his three lectures at a meeting to be held at 8 P.M. on April 8th. It is hoped that a discussion will follow.

A lecture will be delivered in Edinburgh on the 22nd, at 8 P.M., by Mr. W. Saville-Kent, F.L.S., F.Z.S., who will treat of the "Commercial Marine Products of Australia."

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Lake Peipus.—In area the Chudskoie lake, as it is called in Russia, is one of the largest in the country, yielding only to Ladoga and Onega. In Russian periodicals the name is applied to the whole lake basin separating Esthonia and Livonia from the Governments of St. Petersburg and Pskof. According to Stukenberg, however, the name properly denotes the northern and largest sheet of water (the Peipus lake)

in this basin, which is connected with the lake of Pskof, farther south, by a kind of strait extending between the islands Pirisar and Sallo. The Russians of the neighbourhood call the strait the Teploie lake, and divide the Pskof, or Talabskoie, lake into two parts—the Severik as far as the Talabski island, and the Teplik thence to the mouth of the river Velikaia. The whole sheet of water, with an area of more than 1400 square miles, is noted for its fisheries, which afford the inhabitants their chief occupation. The lakes, offering no serious obstacle to navigation, played a great part in the transit of goods up to the construction of railways, and even now are of importance in the trade between Pskof and Yurief (Dorpat).

The attention of the administration was first drawn to the lake through the inundation which occurred in 1844. Then the water rose, it is said, four or five feet above its normal level, and spread itself out to the banks of loose sand which as a rule are separated from the lake by a strip of shore thirty to forty feet broad. Consequently, it was determined to consider the question of lowering the level of the lakes ; but nothing was done until 1853. Exactly what kind of investigations were then made does not appear, or whether soundings were included ; at any rate, only a few general statements were made about the depth.

Fuller investigations were carried out in 1895 by I. B. Spindler, including soundings, observations of temperature both on the surface and below, observations of transparency, etc. (*Izvestiya* of the Russ. Geogr. Soc., No. 4, 1896). Colonel Spindler's soundings show that the Chudskoie lake, the area of which is about 1070 square miles, has an average depth of 24·6 feet. Its central part is an even depression not exceeding 44 feet in depth, a few ridges and channels being found only in the southern part. The bottom is composed, according to M. Zengbush's examination, of diluvium from the eastern and western shores. In general, it is covered with clayey or sandy mud or sand, but in some places red Devonian sandstone was found. The water is somewhat highly charged with solid matter, the average percentage being 0·17, whereas in the Alpine lakes it is 0·15, as given by M. Delebecque. Consequently, the transparency is low, the Forel twenty centimètre disc ceasing to be visible at a depth of 9·4 feet in the middle of the lake, and at 6½ and 7 feet near the bank at the southern end. In the Alpine lakes the limit of visibility is 16 to 20 feet in the summer months.

The temperature of the surface water varies markedly with the state of the weather. On a clear, calm day the temperature over the deep part of the lake was fully 3½° F. warmer than at ten o'clock in the morning and eight in the evening, while the difference between the temperature of the air and water increased from the morning from 4·7° to 5°. From the surface the temperature falls gradually from 67·5 to 32·8 at a depth of 33 feet. Then there is a sudden change, the temperature falling 3·8° in one foot. The lowest temperature recorded at the bottom in 40 feet was 54·1°, the surface temperature at the time being 68·4°.

The difference between the highest and lowest levels of the water during the course of the year is about 4½ feet. As to the question whether there is any progressive change in the mean level, it is yet undetermined, and stands much as it did forty years ago.

The End of the Alps.—The Lammbach catastrophe in the Bernese Oberland has called forth the following calculation. The Aare carries annually 177,000 cub. yards of detritus to the Lake of Brienz, thereby constantly displacing its bank. Since the lake extended to the rocky barrier of the Kirchet fourteen to fifteen thousand years must have elapsed, and thirty-five to forty thousand more must pass away before the lake, about 1·24 cub. miles in volume, is entirely filled up. Again, from every square mile of the basin of the Aare above Meiringen, nearly 22,900 cub. feet

of rock are swept down into the valley every year, and the mountains will thereby be lowered one foot in about 1016 years. As, then, the sources of the Aare lie 7414 feet above sea-level, in about seven and a half million years the Aare glaciers will have disappeared and the valley be reduced to a uniform level; and in sixteen million years the last block of rock will have been worn down to sand and carried out to sea.—*Deutsche Rundschau*, Jahrg. xix. Heft. 6.

ASIA.

Travellers in Tibet.—The *Geographical Journal* for February contains short reports of the travels of Captain Wellby and Lieut. Malcolm, and of Captain Deasy. The former travellers, being sent back across the Wapu-La pass (18,434 feet) by Tibetan officials, travelled from the Lanak-La across Tibet, keeping for the greater part of the way between 35° and 36° of north latitude, and, therefore, far to the north of Bower's route, and through the middle of a large tract of unknown country. They passed through barren, grassless country with many salt lakes, and during June and a greater part of July had to dig for water, and frequently go without altogether. The heat in the sun was great, though the nights were cold. Once in June there were 18° of frost at night, and the thermometer went up to 105° at midday. Game became scarce in August, and the party had to subsist on wild onions, which grew in enormous beds. They followed a river down to a big lake, and then came to the source of another river, beside which, on September 6th, they fell in with a merchant travelling to China, who informed them that the river was the Chumar, the main source of the Yang-tse. Probably it is the Ma Chu or Red river of A-K., in which case the lake may be the Lake Montcalm of Bonvalot. The northern tributary of the Yang-tse, the Napchitai-ulan of the Mongols, is also called Chu Ma or Ma Chu by the Tibetans. The subsequent journey of the travellers was past the Koko-nor through Tankar, Sining, and Lan-chau. Plane-table work was carried out through Tibet by an Indian surveyor, latitudes were taken with the theodolite and sextant, and altitudes and temperatures were recorded.

Captain Deasy marched from the Lanak-La past Mangtza Cho to Yeshil Kul, and then due east to a barren and waterless country, through which he travelled northwards to the Aru Cho. On the edge of this inhospitable country large numbers of antelopes were seen, no fewer than 15,000 being in sight at one time. Turning south, Captain Deasy crossed Bower's route on the west side of Aru Cho, and, passing the south-west corner of Charol Cho, entered British territory close to the north-west corner of the Pangkong lake, having explored 700 miles of Tibet. The extent of country surveyed was 23,000 square miles, and the heights and positions of over 250 peaks were fixed trigonometrically. At almost every camp observations for latitude, time, and azimuth were taken, as well as over 200 observations, during the course of the expedition, to determine the variation of the compass.

A Journey across Borneo.—In vol. xi. p. 140 it was mentioned that Dr. Molengraaff was prevented from descending the Mahakkam by disturbances among the natives. On that occasion he was accompanied by Dr. Nieuwenhuis, medical officer in the Dutch East Indian army, who shortly afterwards heard that the reports of the disturbances in the Mahakkam district had been much exaggerated and found that the Kayans of Mendalan were quite willing to accompany him across the watershed. Accordingly, he started last July from Poetoes Sibau, and followed the same route as in 1894 to the Penaneh river, a tributary of the Mahakkam. The passage of the watershed was a laborious undertaking, but all

the baggage was at length conveyed to Penaneh, the first house in the Mahakkam basin. Two days Dr. Nieuwenhuis spent with Belare, a notorious Dyak chief, by whom, however, he was well received, and then he moved on to Long Bloeoe, the residence of the great Kayan king, Kwing Irang.—*Tijdschrift van het K. Nederl. Aardrijkskundig Genoot.*, Deel xiii. No. 6.

AFRICA.

Egypt.—The report of Lord Cromer, presented to Parliament in February, contains much interesting matter. A large proportion, naturally, does not relate to geographical subjects. We may, however, give a few extracts. A railway is being made from Mansurah to Matarieh, the centre of the Lake Menzaleh fishing industry, and it is expected that the entire length of sixty-five miles will be completed by the middle of the present year. In Upper Egypt good progress has been made on the line between Girgeh and Keneh, and by the end of the year railway communication will probably be established between Cairo and Aswân. It has been decided to continue the broad gauge as far as Luxor; south of Luxor, the Sudan Railway, with a gauge of three feet six inches, will commence. Irrigation and drainage must always occupy a prominent place in a report on Egypt. Since January 1st, 1896, the water level on the Victoria Nyanza has been recorded daily at Port Alice, Port Victoria, and Lubwas Usoga. These records will, Mr. Garstin affirms, be of the utmost importance to Egypt, and he hopes that similar gauges may be erected on the Albert Nyanza. In consequence of the re-occupation of the province of Dongola, information concerning the rise of the Nile was obtained much earlier last year than has been possible in recent times. The barrage has required attention, owing to the formation of springs, but nothing has occurred to cause anxiety concerning its stability. £E.52,000 were spent in drainage, including the cost of pumping out Lake Mareotis (vol. ix. p. 192). The census of 1882 was very imperfect, and many changes have certainly taken place since then; another will be taken this spring or summer. The work of excavating the temples at Philæ has been completed, and a report by Captain Lyons, R.E., will shortly be published. Great progress has also been made at Karnak under the direction of M. de Morgan.

Uganda.—Mr. E. J. L. Berkeley's report (*Diplomatic and Consular Reports on Trade and Finance, No.* 1844) gives an encouraging picture of the state of Uganda. Mumia's in Kavirondo east of the Nile, and Mengo or Kampala, the capital of Uganda, are the chief centres of trade. Kavirondo has been thoroughly pacified, and now trading caravans make their way without opposition to the north of Elgon and into Turkana, where ivory can be obtained on easy terms. In Uganda, not only has the bulk of the trade increased, but a demand has arisen for articles of a better class than cloth and wire. Clothing, provisions, soap, materials, tools, etc., are imported in considerable quantities. The export trade still consists exclusively of ivory, but the more intelligent Waganda are fully alive to the importance of fostering native products, such as coffee, rice, cotton, tobacco. Of natural products, vanilla and india-rubber may offer a good field for enterprise. There is a very remarkable increase in the value of the trade. In 1894 the value of the imports was 78,759 rupees; in 1895 it rose to 222,006 rupees, and amounted to 240,620 for six months of 1896. For the exports the figures for the same periods were 87,697, 244,728, and 150,895 respectively. In 1896 a considerable proportion of the imports were purchased by the Administration, and a good deal of expense was incurred by traders in establishing themselves in the country. These circumstances account for the excess of imports over exports.

At Kampala, principally, experiments have been made in the cultivation of useful plants. More definite results will be obtained now that trained gardeners have arrived from India. But so far the plantation of rice, cotton, oil, seeds, and European vegetables has been attended with great success. Tobacco has been tended with more care than heretofore, the coffee will probably sell at £90 a ton in European markets, when properly prepared, and promising experiments have been made with several kinds of fruit trees. The Waganda have been urged to guard against the great drain of timber, and now 5000 acres, not far from Mengo, have been set apart for forest culture; 1000 trees are to be planted each year for five years.

Lake Kivu.—The agents of the Congo State have lately explored this lake, heard of by Stanley under the name of Oso, and first seen by Count von Götzen (see vol. xi. pp. 30 and 197). It lies at an altitude of 4900 feet or nearly 2300 feet above Tanganika. The mountains shut it in closely, especially on the west. This side, however, has not been thoroughly explored, and it is impossible to say whether the large island Kwishwi, which Von Götzen places in the centre of the lake, is an island or a peninsula. The Rusizi, only sixty miles in length, forms a succession of falls, the most important being those of Pembo, where the river leaves the lake. Here the river has forced its way through a narrow gorge above which, on the east, the mountain Dagoro rises to a height of 7900 feet. On the north the basin of the Congo is separated from that of the Nile by the volcanic group of Virunga (Mfumbiro), the highest summit of which is 11,380 feet.—*Mouvement Géographique*, No. 8.

New Lakes between Kilimanjaro and Meru.—On his return march from Meru to Arusha, Lieutenant Merker, on June 7th, came upon an unknown lake called the Nyoro Lkatende by the Wandorobbos of the neighbourhood. Its longer axis, running from north-west to south-east, probably measures seven and a half to nine miles, while its greatest breadth, at the north-western end, is three to three and a half. Numerous hills, with a relative height of 300 feet, close it in on all sides and project into the water in the form of promontories. A range running across the lake nearly due east and west appears above its surface as a row of islands. The water is slightly saline. Bird life is not so abundant as on the Manyara lake, only a few ducks, gulls, and herons being seen, but numerous hippopotami frequent the bays. About two miles to the east lies a smaller lake, two to three miles in diameter, the Ndoroto Melo, which harbours a large number of hippopotami. The surrounding country is stony and hilly, and covered with very dense brushwood. Except rhinoceros, there is apparently no game, as little forage is to be had.—*Mitth. aus den Deutschen Schutzgebieten*, Bd. ix. Heft 4.

The Congo Basin.—In vol. xii. p. 427, Dr. J. Cornet's theory as to the formation of Lake Tanganika was briefly described. More recently we have received from the author two reprints from the *Bull. de la Soc. Belge de Géologie*, in which he treats of the superficial deposits and erosion of the Congo Basin and the general geology of its western portion. Dr. Cornet's investigations are of great interest to geologists, but are too detailed, and of too purely a technical character, to be reproduced here at any length. A few statements on the superficial deposits may be extracted from the conclusion of his paper. The Congo, he says, is of recent formation, for the excavation of its bed is not far advanced, and other evidence points to the same conclusion. At one time its waters fed a large lake which occupied a large part of the basin, and in which were deposited the massive strata of the soft sandstones of the Upper Congo. Then there came a time when an

emissary found its way out of the lake, which rapidly excavated a bed for itself, lowering the level of the lake, and exposing large stretches of the fluvial deposits, in which the feeders of the lake eroded new channels, carrying the *débris* down again to the contracted lake. Thus, the lake became more and more restricted, while its affluents continually lowered their beds, as the level to which they tended was ceaselessly falling. This process is still going on actively. To what extent the excavation of the bed of the river has been accompanied by a general upheaval of the country, Dr. Cornet refrains from discussing in the article quoted from. At all events the rise indicated by the estuarial deposits in the coastal zone is far inferior to the lowering of the valley of the Lower Congo since it came into existence.

Johannesburg.—Founded in 1886 as the centre of the Witwater gold-fields, the town of Johannesburg contained only 3000 inhabitants in April 1887. By January 1890 the number had risen to 26,303, and the growth continued during the following years, though not with quite the same rapidity, so that Johannesburg is now the second largest town in the continent of Africa. In July 1896 a census was taken of the inhabitants in the town and in the suburbs within a radius of three miles. The population of the town itself was ascertained to be 48,331, and of the whole area of fully 28 square miles, 102,078. The males were 79,315 and the females only 22,763. Another fact that marks the mining character of the town is that 63 per cent. of the people are between the ages of 15 and 30. The British element preponderates, with 67 per cent. of the total white population (50,907), while the natives of the Transvaal only account for 12 per cent. The white male inhabitants over 16 years of age number 25,058, and of these 1039 are native citizens of the Republic and 516 have been naturalised. Thus only 6 per cent. of those capable of exercising political rights possess the franchise, and only $1\frac{1}{2}$ per cent. of the total population. Of the black labourers (42,533) only 754 are natives of the Transvaal, the remainder coming from British and Portuguese territory and Swaziland. 93 per cent. of the total population of Johannesburg are immigrants.—Dr. Supan in *Petermanns Mitt.*, Bd. xliii. No. 2.

AMERICA.

The Topographic Work of the U.S. Geological Survey.—Mr. Henry Gannett, Corr. Member of the Society, contributes the following statement of the work of his department :—

During the year 1896 the U.S. Geological Survey has added 21,000 square miles to the surveyed and mapped area of the country. The distribution among the different States of the areas surveyed during the year is shown in the following table :—

	Sq. Miles.		Sq. Miles.		Sq. Miles.
Arkansas,	250	Maryland and Delaware,	1278	Oregon,	419
California,	1200	Michigan,	144	South Dakota,	1800
Colorado,	238	Missouri,	900	Texas,	609
Idaho,	525	Montana,	883	Vermont,	219
Indian Territory,	5000	Nebraska,	1800	Washington,	812
Iowa and Illinois,	1150	New York,	2570	West Virginia,	1250

In addition to the newly mapped areas, 4292 square miles of country which had been mapped during the earlier years of the work, were revised for publication upon a larger scale.

In Vermont, but one sheet, lying in the Green mountains, was executed. In

New York thirteen sheets were mapped. The large amount of work done in this State was in great part due to the fact that the State, by appropriation, voted financial assistance to the Survey. The areas surveyed in the State lie in the Adirondack mountains, in the Mohawk valley near Utica, in the Finger lake region, in the plateau in the south-western part of the State, and in the north-western part of the State near the shores of Lake Ontario.

The areas surveyed in Delaware and Maryland lie between Delaware Bay and the head of Chesapeake Bay.

The areas in Illinois and Iowa lie in the western part of the former State and the eastern part of the latter, including a portion of the immediate valley of the Mississippi river. That in Michigan is in the heavily forested, glaciated region of the upper peninsula. The area surveyed in Missouri lies in the south-western part of the State, in the region once famous for its iron mines, now for those of zinc. In Arkansas, the region about the celebrated hot springs of that State is included in the work. The area mapped in Nebraska is in the extreme western portion, upon the high plains ; while that in South Dakota is in the south-eastern portion, bordering upon the Missouri river, near the mouth of James river. The work in Texas has been carried on in the southern part of the State, in a region covered with groves of mesquite. In Montana, a mining region lying south of Helena has been surveyed, and in Idaho, also, a mining region in the Salmon river mountains has been the country mapped. The area surveyed in Washington lies upon the east slope of the Cascades, and includes the upper part of the Yakima valley. In Oregon the surveys were made in two regions, one upon the Pacific coast near Coos Bay, the other around Portland. In California, also, two regions were under survey, viz., one about the Bay of San Francisco, the other near the summit of the Sierra Nevada.

In Indian territory a large area, about five thousand square miles, was mapped in connection with the survey and subdivision of the Indian lands, which is now being carried on by this organisation.

The areas in which revision was done were mainly confined to the Appalachian mountain region of the Southern States—West Virginia, North Carolina, Georgia, and Alabama.

The Revilla Gigedo Group.—Captain P. H. Salva sailed last November in the *Oaxaca* to inspect the group on behalf of the Mexican Government. He anchored in Ensenada Bay, Socorro Island, lat. 18° 42′ 57″ N. lat., and 110° 56′ 53″ W. long., and sent Lieutenant Guilebaldo on shore to reconnoitre. Some springs of fresh water were found, and an untenanted house two miles north of Braithwaite Bay. From the highest peak a general view of the island was obtained. Few large trees were seen, but of shrubs and underwood there was a luxuriant growth, and rich pastures. A quarter of the island is of barren volcanic rock, while the rest is good agricultural land. There were asses and sheep on the island, the latter being in good condition. The bay and cove are full of fish. Another empty house was found on the north coast, where a paper was discovered stating that the house had been built by certain men from San Diego. Clarion Island was also visited. It contains no fresh water, and consequently no cattle or human beings. Landing is difficult owing to the surf. Roca Partida and San Benedicto were visited, but no landing on them was effected. They are uninhabited and uninhabitable. Like Clarion they swarm with sea-birds.—*South American Journal*, January 19th.

The Commander Islands.—Mr. Leonhard Stejneger, member of a commission to investigate the seal islands of Bering Sea, has published a treatise accompanied by a chart. He regards it as well established that the Commander Islands are

situated on the extreme eastern point of a plateau-like ridge jutting out from the coast of Kamchatka, with an average depth, probably, of 500 fathoms. The plateau rises abruptly from an ocean floor of rather more than 2000 fathoms, so that the islands on their northern and eastern sides rise nearly perpendicularly from this depth. Between the Commander Islands and Attu, the nearest of the Aleutian Islands, is a gap certainly more than 1900 fathoms deep. The bottom of Bering Sea east of Commander Islands is a nearly level floor at a depth of 2000 fathoms, and an arm of nearly the same depth stretches to the north of the islands towards the neck of the Kamchatka peninsula.—*Bull. of the Am. Geogr. Soc.*, No. 4, 1896.

The Gulf of Maracaibo and its Asphalt Deposits.—This gulf penetrates deep into the South American continent, and is connected at its southern end, by a strait thirty miles long and twelve broad, with a still greater lake of the same name, the two forming an expanse of water 218 miles long by more than sixty broad, equal in area to the Gulf of Finland. Though the lake is connected with the sea, its water is nearly everywhere fresh, at any rate in the upper layers, and even at the town of Maracaibo, situated on the strait, has hardly any flavour of salt. This is due to the numerous large rivers which enter the lake, especially at its southern extremity, and to the bar, with only ten or twelve feet of water over it, which blocks the entrance and is a great hindrance to the important trade of the town, whence goods are transported from and to a large part of Venezuela and Colombia. The shipping on the lake is restricted to a few small steamers, which ply between Maracaibo and Cucutá on the Zulia river, the chief centre of the coffee exportation from Colombia.

The climate, among other causes, has prevented a thorough exploration of the shores of this inland sea; even in the north, though the climate is dry, yellow fever prevails, and in the more southern, wetter, districts is so virulent that many places are quite uninhabitable. The town of Maracaibo possesses some of the latest improvements, such as electric light and tramways; but the streets are for the most part unpaved and sandy, and the neighbourhood bare and dry, constant irrigation with water raised from the lake by windmills being necessary to keep the gardens of the villas green. The soil is a reddish yellow sterile sand mixed with a large proportion of mica, and the scanty vegetation consists of cactus, acacia, croton, dry stiff grasses and other plants that can live in deserts.

Baron H. Eggers wished to visit the asphalt deposits on the eastern side of the lake, and on March 8th set out in a primitive boat from Maracaibo and, on reaching the opposite coast, skirted it towards the south. On the banks grow mangroves, alternating with other dense timber. Having passed the Punta de Misoa, a wooded promontory, the vessel cast anchor off San Timoteo, a small village situated on a patch of firm ground a little above the surface of the lake. The forest at San Timoteo presents a strong contrast to the dry vegetation of Maracaibo, being particularly rich in palms, though it does not always wear the verdant dress of the damper but malarious country farther to the south. From January to March is the dry season here, when most of the trees lose all or a great part of their leaves. Starting at four o'clock in the morning, Baron Eggers reached at nine the Cuesta de la Savana, the inner boundary of the coastal plain. It is built up of coarse *débris* and sand, and probably was once the shore of the lake when the whole plain of San Timoteo, six miles broad, lay beneath the waters. This slope leads up to a tableland (*mesa*) with a reddish soil mixed with numerous stones. The surface of the tableland is slightly undulating, and is thinly covered with grass interrupted here and there by a few low trees and copses. On the north it extends to the

ravine of the Rio Misoa, while on the south it is bordered by the Rio Motatan and its affluents.

The deposits of pitch occur in two groups—El Menito, north of the Rio Misoa, near the western slope of the chain of hills of the same name, and El Mene Grande more to the south. *Mene* is the local name for pitch. The Menito is a rounded hill with a somewhat gentle slope, and composed of reddish stony soil covered with scanty grass. Over its summit are scattered a number of small truncated cones about two feet high, with round, crater-like openings, from which the pitch flows in a black viscous stream down to the foot of the hill, where it collects in all the hollows, forming pools and even small lakes. If a boring be made in one of these cones, it is found to consist of earth mixed with water and asphalt; but the last runs out quite pure. The outflowing asphalt is quite cold, a little below the air temperature, and hardens after a few days. Animals often stick fast in the fresh asphalt, and many skeletons are found imbedded in it. On the northern side of the Menito hill are caldron-shaped hollows, where hot water wells up. Its temperature is 167° F., yet it is covered with a thread-like bluish-green *alga*, such as is found in other warm springs. The water is mixed with fluid asphalt, and a fluorescent-film, having the appearance of petroleum, floats on its surface. The Mene Grande is very similar, but yields a much larger quantity of asphalt. Baron Eggers roughly calculated its daily output at over twenty tons. The largest accumulation he found in a ravine running from the hill towards the south-west, and extending for a distance of more than half a mile, with an average depth of at least forty inches; probably the mass weighed nearly twenty thousand tons. At other places round the lake, inland from Lagunillas and farther north near St. Rita, there are said to be other deposits of asphalt, though not so rich as those near San Timoteo. The largest export from Maracaibo in one year was 1580 tons, in 1883, since when the industry has declined year by year. Better political and social conditions must be introduced before this and other natural sources of the country can be properly exploited.—*Deutsche Geographische Blätter*, Bd. xix. Heft 4.

The Xingu River.—On his first journey to the region, Dr. v. d. Steinen discovered the Batovy, the middle of the three streams which form the Xingu. On his second expedition he intended to explore the Kuluëne on the east and the Ronuro on the west, streams which he had seen only at their confluence, but, being led astray by an ignorant guide, he came upon the Kuliseu, an affluent of the Kuluëne, which he explored to its mouth, navigating the lower course of the latter river also. The work of Dr. v. d. Steinen has now been continued by Dr. Herm. Meyer, who, accompanied by Dr. Ranke, left Cuyaba on May 11th 1896, and following pretty closely the route of the first Xingu expedition to the Paranatinga, an affluent of the Tapajos, navigated it for a distance down stream. Then the expedition marched eastward and after three weeks came to the Ronuro, which was surveyed upwards and downwards to its confluence with the Kuluëne. The current in the Kuluëne was so rapid that the journey along it had to be made by land. During three weeks the whole country between the Kuliseu and Kuluëne was explored. The latter is a much more important river than the Ronuro, and is considerered by Dr. Meyer to be the true upper course of the Xingu.—*Petermanns Mitt.*, Bd. xliii. No. 2.

The Chaco.—P. Joaquin Remedi, having lived for twelve years as a missionary among the Matacos of the Gran Chaco, has written a monograph on these Indians and their language, to which is prefixed an introduction on the physical features of

the country. In order to make the work more accessible, Señor Lafone Quevedo has reproduced it in the *Bol. del Instituto Geogr. Argentino*, Tom. xvii. Nos. 7-9.

The surface of the Chaco is almost horizontal, and the slight inequalities are almost all knolls of alluvial formation, which, aided by the loose sandy soil, cause the rivers to change their courses frequently. Thus the Pilcomayo, Bermejo, and Salado, and particularly the former two, from the points where they leave rocky ground and emerge into the Chaco, occupy no fixed beds, at least in their western and central parts, describing huge curves, flooding the country, and dividing into numerous arms. The waters of the Bermejo are heavily laden during floods with earthy matter, which they deposit on the inundated lands, causing these to rise by degrees, so that the river is obliged to send its superabundant water in another direction. Sometimes very sudden changes are produced; trunks become fixed in the bed of the river, and the *débris* carried by the current being caught by the obstacle, a dam is soon formed, and the river is forced into some other channel; or the river itself may undermine its bank, and find its way into some adjacent hollow or old channel.

The climate of the Chaco is very dry and healthy. The temperature is high, the thermometer rising in summer to 115° F. in the shade; but in winter it descends to a degree or two below freezing-point. Rain is scarce; at most there is a shower in winter, and in spring a few drops hardly sufficient to lay the dust, while from April to November not a drop falls as a rule. Fresh water may be obtained by digging down to a depth of about twenty feet in the abandoned river beds. For a distance of some twenty leagues into the Chaco from the eastern frontier of Salta no hills or ridges are visible. Nevertheless, there is no monotony; here are fields carpeted with verdant pasturage, relieved by groups of trees, and edged by a strip of wood that forms the background; there stand groves of palms with graceful trunks that raise their crowns aloft far into the air. Dense woods give place to sterile knolls covered with stunted thorny vegetation, and branches of the river, here dry, there full of water, intersect the country in all directions. Though the Chaco, with its dry air and saline soil, has not the vigorous and exuberant vegetation of the tropical zone, it is not as open as the Pampas. It has its large woods, and indeed it would be entirely covered with forest, were it not for the destructive force of its rivers. But the timber is of no great height, the palms rising to fifty or sixty feet, and the other trees to only thirty or forty. Many of these furnish excellent material for construction, and there are also plants yielding dyes and medicines. Where the moisture is sufficient, wheat, maize, rice, manioc, sweet potatoes, etc., may be grown, as well as sugar-cane, cotton, tobacco, and fruits. But such lands are those which are subject to inundation, where only wheat and certain vegetables can be sown. As a rule the first year's crop does not repay the expenses of clearing the ground, etc., while at any time changes in the bed of the river may remove the floods to another part of the basin. Grazing is the most profitable occupation in this country, though it also is liable to be affected by the changes already referred to.

The rivers of the Chaco, and the Bermejo in particular, abound in fish large and well-flavoured. Birds are very numerous, and of all sizes, from the ostrich to the humming-bird. The jaguar and puma, wild cats, deer, foxes, and viscachas are some of the wild animals; poisonous reptiles abound as well as insect pests.

The Matacos Indians seem to be still in a very low stage of civilisation and morals. Numbering some fifteen or twenty thousand souls, they dwell on both margins of the Pilcomayo and Bermejo. P. Remedi describes them as abject, cowardly, indolent, wanting in intelligence, and born thieves. They live by the chase, and on fish and wild fruits.

AUSTRALASIA.

German New Guinea.—In vol. xii. p. 649 Dr. Lauterbach's route was traced to a distance of sixty miles from the coast, where he had formed a station near a river which flowed in a westerly direction. He followed the stream fifteen miles farther, first westward, and then north-westwards, to a plain which he had seen before from an elevated spot. Leaving the stream here, the party marched south-westward through fine forest, afterwards giving place to large sago swamps, and on July 10th came to a voluminous navigable river, 100 yards broad, which flowed towards the north-west. Here they camped at the foot of the Bismarck mountains, and set to work to construct fifteen canoes. On August 3rd they embarked and paddled down the river, which led them 125 miles in a north-westerly direction, and then turned northwards. On the left bank the spurs of the Bismarck mountains, 3300 to 6600 feet high, approach at places close to the river, and a number of large tributaries descend from their flanks. Northwards and north-eastwards lies level country. At first the country was thinly peopled, but after descending the stream for some distance, the party was boldly attacked by natives unacquainted with fire-arms. Having navigated the stream downwards till August 14th, when the bed was 220 to 380 yards broad, the expedition returned to their camp, and Dr. Lauterbach and Dr. Kersting climbed one of the Bismarck mountains, 3300 feet high, whence they could see the river, called here Yagei and lower down Ramu, and probably identical with the Ottilien, for a distance of sixty miles to the south-west. A plain eighteen or twenty miles broad extends behind the Finisterre mountains, skirting the Bismarck range (which lies about sixty miles farther to the south-west than it is marked on maps) and its prolongations up to the ranges lying to the right of the Augusta river, where it bends, here fully sixty miles broad, northwards to the sea. North of the Gogol, ranges 3000 to 6000 or 7000 feet high run parallel to the coast, gradually sinking to the plain on the north. Between the Gogol and Ramu plains are only low ridges. The soil of the plain seems to be alluvial; it is covered with forest, and thickly peopled. On the highest summits of the Bismarck range, 13,000 feet high and more, snow was sometimes observed.—*Deutsche Kolonialzeitung*, Dec. 26th.

Funafuti.—Mr. C. Hedley of the Australian Museum has written a detailed account of this atoll, which is published as *Memoir III.* of the Museum. The Ellice group is but a link in a huge chain of islands which extends for about 3500 miles from the Austral Islands through the Herveys, Samoas, Ellices and Gilberts to the Marshalls, forming the south-western edge of the axial trough described by Dana as the Central Depression of the Pacific. West of this line of upheaval is a second, with a contour, as shown by the *Challenger's* cross sections, as of waves directed westwards. The fauna and flora of the latter series is characteristically continental, in contrast to the essentially drift fauna and flora of the outer chain, from which also it is distinguished by the presence of volcanoes. The term Melanesian Plateau has been proposed for these elevations (vol. x. p. 39), which during the life of the existing fauna has been first deeply sunk and then slightly elevated. It is noteworthy that the only place where the outer ring of elevations encircling Australia has swelled out into large and lofty islands is where, in the Samoan archipelago, it has swept on to the heel of the Melanesian Plateau.

After briefly describing the other islands of the Ellice group (of which some details were given in vol. xii. p. 649), Mr. Hedley passes on to a more particular account of Funafuti. The atoll was discovered by Captain Peyster in 1819. It lies in lat. 8° 30′ 45″ S. and long. 179° 13′ 30″ E., and is about a thousand miles

south-south-west of what Dana considered the centre of the great Pacific subsidence. In outline Funafuti resembles a pear, with the stem turned towards the south. The lagoon, ten miles long by eight broad, is plentifully besprinkled with shoals, some of which rise to the surface; its average depth is about twenty feet, and maximum depth thirty feet. Soundings taken outside the atoll rim by Captain Mervyn Field of H.M.S. *Penguin* have shown that Funafuti is not seated on any ridge common to the group or connected with any of the other islands by a bank, but rises independently from the abyssal floor of the Pacific. Nukulailai is similarly situated; wherefore it may be concluded that the islands of the archipelago are a range of deep sea cones.

The lagoon of Funafuti seems to be in course of filling up. Scattered over the whole are numerous small reefs, which are in a thriving condition and evidently growing vigorously. In summing up the results of the geological observations, Mr. Hedley states that an elevation of Funafuti of at least four feet is proved by sub-fossil reef-corals near high-water mark; that soundings show that the atoll stands on a cone, is surrounded by a precipitous submarine cliff, and that the lagoon is being filled up—all which facts he considers can be explained only by Darwin's subsidence theory. A peripheral growth on both sides of the islets is indicated.

Mr. Hedley treats also of the climate and vegetation, and of the inhabitants, their language and customs.

The Southern Continent.—In the latest volume of the *Journal and Proceedings* of the Royal Society of New South Wales is a paper by Mr. C. Hedley in which he discusses the theories proposed to account for the community of forms of animal life between South America, New Zealand, and Tasmania. Professor Hutton supposed that a land connection once existed with Chile through Samoa, by which South American species found their way westwards; but, in that case, New Zealand, being the most distant land, should contain fewer of these forms than Samoa or Tahiti, whereas, in fact, these islands contain none at all. Nor is the theory consistent with the configuration of the ocean bottom, for an enormous rise would be required to form a bridge across the Pacific. Against Mr. H. O. Forbes's theory of an Antarctic continent Mr. Hedley has several objections. The fauna and flora of so large a continent would, he thinks, have exhibited a larger variety of forms, and the survivors would have been fairly evenly distributed among the southern land masses. His own theory is that in Mesozoic or Older Tertiary times a strip of land extended across the South Pole from Tasmania to Tierra del Fuego, and that New Zealand then approached near enough to this land to receive from it many plants and animals by flight or drift; for venomous snakes, marsupials, etc., did not reach New Zealand. It is admitted by all that New Zealand once extended far to the south, to or beyond the Macquarie Islands, and Tasmania seems to have been prolonged in the direction of Royal Company Island.

MISCELLANEOUS.

The drainage of the **Chalco Lake** in the valley of Mexico is progressing rapidly. A large tract of exceedingly fertile land will thus be laid bare. A railway is already being made to the capital, and houses, stables, and barns will be erected with every modern improvements, and bricks will be made on the spot by steam machinery.—*Aus Allen Weltteilen*, Heft 9, 1897.

Another balloon expedition in the **Arctic Regions** is being organised by MM. Godard and Surcouf, two French aeronauts. They are to start in the spring of 1898 in a balloon having a capacity of over 35,000 cubic feet, and capable of

remaining in the air for sixty days. The cost of the undertaking is estimated at £10,000.—*Verh. der Gesell. für Erdkunde zu Berlin*, No. 1, 1897.

Some geologists of repute believe that **Petroleum** exists in many parts of South Africa—in the Transvaal, Natal, the Orange Free State, and generally in the subsoil of the Karroo. The first soundings, by an official appointed to this work, are to be made between Clanwilliam and Uitenhage, which seems to be the centre of the volcanic and dioritic formations. Most of the deposits will probably be found 400 feet above sea-level and upwards.—*Mouvement Géogr.* No. 9.

Mr. Peary intends to make another expedition towards the North Pole from the American side. This time he will select a more northern point for his winter quarters, namely, the Sherard Osborn fiord, discovered by Lieut. Beaumont of the Nares' expedition in 1876. He will then march northwards to the farthest limit of the islands off the north coast of Greenland, possibly in lat. 85°, and having passed the winter there, will set out again as early as possible in the following summer.—*Petermanns Mitt.*, Bd. xliii. No. 2.

The Mexico, Cuernavaca, and **Pacific Railway**, which, when completed, will connect the city of Mexico with Acapulco, will be about 351 miles in length. Like the Denver and Rio Grande line it will render accessible a country of great scenic beauty. From Mexico it winds through the fertile valley to Cuernavaca and thence to Puente de Ixtla through the Xochitl valley. Much of the country through which it passes is of the highest agricultural value. The line is being solidly constructed with the best material.—*The South American Journal*, Feb. 20th.

Mr. R. H. Scott, Secretary of the Meteorological Office, writes to say that the meteorological observations at **Cape Juby** were made for his Department, not for the R. Meteor. Society as stated on p. 115. He also adds that the rainfall at Cape Juby in 1894 was 5·735 inches; that of 1893 was less, but not *three* inches (*see* p. 116). It was Dr. Zaytoun who registered the fall during these years, but, having sent all his records to the Meteorological Office, he could only speak from memory when lecturing in Edinburgh. His impression was that the rainfall of 1894 was remarkably small.

A **new waterfall**, which is probably one of the largest in the world, has lately been discovered by an explorer in the service of the Orinoco Company. As the discoverer was laboriously making his way among the Imàtaca mountains, he heard the roar of water and guided by it came to a fall of unusual dimensions. The river breaks diagonally through a vertical wall of rock 1600 feet high, separating into a number of jets, which reunite at the foot of the precipice, and flow away in almost the opposite direction from which they began their descent.—*Deutsche Rundschau*, Jahrg. xix. Heft 6.

On p. 316 of vol. vi. the plans proposed for the draining of the **Zuider Zee** were described at some length. The commission appointed by the Dutch Government to inquire into the matter has recently sent in its report. The work would be extended over thirty-one years, and every year 24,700 acres of land would be reclaimed. The dyke from the coast of the province of Holland to Friesland would take nine years to construct. The length required is thirty miles, and the other dimensions have been fixed at 115 feet for the breadth at the base, and nearly twenty feet for the height. The total cost, including an indemnity to fishermen, is estimated at twenty-six million pounds sterling. On the other hand, the

value of the reclaimed land is estimated at twenty-seven millions, so that a profit of one million would be obtained.—*Revue Scientifique*, Feb. 6th.

In *Petermanns Mitteilungen*, Bd. xliii. No. 1, Dr. Supan publishes a map of the **Arctic Regions**, on which is marked the area still unknown. The area of the South Polar regions yet to be explored is also marked, each point of the boundary being placed on its proper meridian but the same distance from the North Pole that the actual place is from the South Pole. Thus we can see how far behind Antarctic exploration is. Ross's "farthest south" was 78° 9½′ S. lat., or about the lat. of the Ice Fiord, in Spitzbergen, where there is now a hotel to which visitors are conveyed by a Norwegian steamship company. Two statements made by Dr. Supan also bring the contrast into relief. The one is that Antarctic exploration is now at about the same stage as Arctic exploration at the end of the sixteenth century; and the other that, while the still unknown North Polar regions are as large as European Russia, the unknown Antarctic has twice the area of Europe.

NEW BOOKS.

Travels in West Africa, Congo Français, Corisco, and Cameroons. By Mary H. Kingsley. With 2 Plates, 16 full-page Illustrations, 29 Illustrations in Text, and Index. London: Macmillan and Co., 1897. Pp. 736.

This book is quite a new departure in African literature, and, after reading it, one is not surprised at its popularity and extensive sale, for such a sprightly, interesting, vivid, and in some respects audacious, account of travels in Africa, it has never been our lot to read—and the author a lady!

Miss Mary H. Kingsley, being intent on the collection of fishes and fetich, with a boldness which is highly commendable, travelled unaccompanied throughout an extensive region on the west coast of Africa, often passing through districts where white man had never trod before, her escort being two or three coast Negroes, reinforced by a few of her well-beloved cannibal Fans. Miss Kingsley loves cannibals; she—well, does not love missionaries.

The great temptation in reviewing this book is to quote, and in many ways this might be a satisfactory procedure, for page after page of either witty or sarcastic or deeply learned gems could with ease be picked out of the volume; but this would not be fair. And indeed the reader will find that even those paragraphs which on the surface are brightly written and exceedingly amusing contain valuable information and show remarkable powers of keen observation.

Apart from the brilliantly written descriptions of tropical scenery, of the difficulties on the march, of cannibal practices, of canoeing with its attendant dangers and upsets, undoubtedly the most valuable part of the book are the chapters on Fetich. Miss Kingsley has gone the right way to work, and has left at home preconceived ideas, and tried to throw herself as much as possible into the mental attitude of the natives with whom she was dealing. As she says herself, "I must warn you also that your own mind requires protection when you send it stalking the savage idea through the tangled forests, the dark caves, the swamps and the fogs of the Ethiopian intellect. The best protection lies in recognising the untrustworthiness of human evidence regarding the unseen and also the seen, when it is viewed by a person who has in his mind an explanation of the phenomenon before it occurs. For example, take a person, who, believing in ghosts, sees a white figure in a churchyard, bolts home, has fits, and on revival states he has seen a

ghost and gives details. He *has* seen a ghost, and therefore he is telling the truth. Another person, who does not believe in ghosts, sees the thing, flies at it, and finds its component parts are boy and bed-sheet. Do not applaud this individual, for he is quite conceited enough to make him comfortable; yet, when he says the phenomenon was a boy and bed-sheet, he is also telling the truth, but not much more of a truth than the observer No. 1, for, after all, inside the boy there is a real ghost that made him go and do the thing. I know many people have doubts as to the existence of souls in small boys of this class, holding that they contain only devils; but devils can become ghosts according to a mass of testimony. Great as the protection to the mind is to keep it, as Hans Breitmann says, 'still skebdical,' I warn you that with all precaution the study of African metaphysics is bad for the brain, when you go and carry it on among all weird, often unaccountable surroundings and depressing scenery of the Land of the Shadow of Death, a land that stretches from Goree to Loanda. The fascination of the African point of view is as sure to linger in your mind as the malaria in your body. Never then will you be able to attain to the gay, happy cocksureness regarding the Deity and the Universe of those people who stay at home, and whom the *Saturday* so aptly called 'the suburban agnostics.'" This shows Miss Kingsley's attitude of mind, and therefore we may be sure that what she writes concerning African beliefs in reincarnation, in man's four souls, of heaven, of witchcraft, and so on, is not jotted down at random, but is the outcome of earnest research and sincere belief in the correctness of her deductions.

The explanation of Ju-ju becomes comprehensible after reading her work, and one seems to understand that, when all is said and done, it is not a mere brutal thirst for blood which causes the human sacrifices, either propitiatory or after a person's death, and, as she justly explains, in districts where poisoning is so rife, the knowledge of a man's wives and slaves that certain of them must accompany him to the nether world at his decease, naturally acts as a deterrent from that crime. Speaking of a man's wives naturally recalls polygamy, and her remarks (p. 212) on that subject are of great interest too, showing, as they do, that it is the women who insist on polygamy, not the men; and a story of an old chief who had three wives, and who profoundly and vividly believed that exclusion from the Holy Communion meant eternal damnation, will give our missionary friends something to think of.

We indicated above that Miss Kingsley does not appear to be fascinated by missions, but it is obvious why; and it certainly would appear that in many ways missions might be conducted on a rather different plan. That she is not altogether prejudiced will be seen by the high terms in which she speaks of various missionaries, "recognising at once the beauty of their natures and the nobility of their intentions. Indeed, taken as a whole, the missionaries must be regarded as superbly brave, noble-minded men, who go and risk their own lives, and often those of their wives and children, and definitely sacrifice their personal comfort and safety, to do what from their point of view is their simple duty; but it is their methods of working that have produced in West Africa the results which all truly interested in West Africa must deplore; and one is bound to make an admission that goes against one's insular prejudice—that the Protestant English missionaries have had most to do with rendering the African useless."

Miss Kingsley has also something to say with regard to the liquor traffic in West Africa. She is not interested in the trade, she assures us, but she has had samples of trade gin tested, and finds that it is no more poison than that purchased in different parts of London. She tell us that the awful photographs which are shown of chiefs' graves decorated by gin bottles are to be explained by the fact that spirit is largely used in Ju-ju, and that a considerable quantity is poured over the graves

and "merely demonstrates that the deceased was taking down with him a little liquor for his own use in the under world—and a little over to give a propitiatory peg to one of the ruling authorities there—or any old friend he may come across in the Elysian Fields. This is possibly a misguided heathen thing of him to do, and it is generally held in European circles that the under-world such an individual as he will go to is neither damp nor chilly. But granting this, no one can contest but that the world he spends his life here in is damp, and that the natives of the Niger Delta live in a saturated forest swamp region that reeks with malaria."

The account of bush trade which Miss Kingsley gives is of great interest, and she shows that on the whole the natives are not over-reached, and at any rate that they know how to hold their own in making a bargain. She thinks that sooner or later the Congo State is bound to fall to France. She writes a most appreciative notice of De Brazza, and confirms all Du Chaillu has written.

Her account of the secret societies in West Africa is extremely interesting, although it is evident that she knows a great deal more than she relates. In fact, very often one is tempted to regret that, wishing to be extremely accurate, she has withheld much of importance and interest. However, she leads us to expect a further volume, and also that she will continue her investigations.

We wish her all good luck, being well assured that, should strength be given her, she will add considerably to the debt of gratitude under which she has placed us.

A History of Dumfries and Galloway. By Sir HERBERT MAXWELL, Bart., M.P. Edinburgh and London: Blackwood and Sons, 1896. Pp. xv+411. *Price 7s. 6d. net.*

That this volume of "The County Histories of Scotland" should have been undertaken by Sir Herbert Maxwell is, on the whole, a fortunate circumstance. It would no doubt have been easy enough to find some other writer who, from the point of view of historical knowledge, would have been better equipped for the task, and this fact has been zealously insisted upon by more than one reviewer. But if the chief end of a book is that it should be read and enjoyed, with the consequent result of stimulating its readers to fresh studies, then it is a happy thing that our guide through the history of Galloway should be this easy, versatile, and graceful writer, rather than some painfully precise historian who, in his conscientious efforts to be accurate, would dull his reader's senses into slumber, and paralyse any latent desire for further research. These observations are made in the full consciousness that Sir Herbert frequently stumbles; and it cannot be denied that this is regrettable. But a book has to be judged from many points of view, and this is a book that interests and teaches, in spite of its defects. The *Waverley Novels*, bristling with error, have taught more history than any professedly historical work.

Of the general outline of the book it is enough to say that, beginning with the Invasion of Agricola, it sketches the history of south-western Scotland down to the end of the last century. Much of its interest consists in the pictures it gives of social life at various periods, and in its stories of family feuds and Border bickerings. The "Monition of Cursing against the Border Clans" is certainly "too fine an example of ecclesiastical execration" to have been omitted; although this is not its first appearance in a modern publication.

But the geographical rather than the historical portions of the book may be more suitably referred to here. There is Timothy Pont's map of *Gallovidia*, reproduced from Blaeu's Great Atlas, 1654; Moll's maps of Annandale, Eskdale,

Liddesdale, and Nithsdale (1725); and, lastly, there is a map of the counties of Wigtown, Kirkcudbright, and Dumfries, which has been compiled for the present work from the modern Ordnance Survey sheets. There is, moreover, an instructive note (pp. 253-4) on Blaeu's geography. One can hardly feel sufficiently grateful to Blaeu, and to his allies Pont, Gordon of Straloch, and Scot of Scotstarvit, for what they have done to rescue Scottish topography from oblivion; and their maps, constantly reminding one of the permanence of place-names, teem with suggestions to the historian and the antiquary. Besides the note just spoken of, Sir Herbert gives a useful list (pp. 400-401) of the "Principal Maps of Dumfriesshire and Galloway," in which are specified eight sub-divisions of Blaeu's Great Atlas, six of Moll's, and other maps of more recent date, of which the latest is Mr. Bartholomew's *Royal Scottish Geographical Society's Atlas of Scotland*, "where a full Bibliography of Atlases of Scotland is given." In all respects this *History of Dumfries and Galloway* is to be heartily recommended to the general reader.

A Cycle of Cathay; or, China South and North. By W. A. P. Martin, D.D., LL.D. Edinburgh: Oliphant, Anderson, and Ferrier, 1896. Pp. 464. *Price* 7*s.* 6*d.*

This book is a valuable addition to the growing literature of the Far East. Its distinguished author went to China in 1850 as a missionary of the American Presbyterian Church, and it was his fortune, as an interpreter and otherwise, to be in close touch with some of the most momentous international questions of the last forty years. His reminiscences of what are now matters of deep historic interest are, on that account, of peculiar value. As translator into Chinese of Wheaton's *Elements of International Law* and other similar works, Dr. Martin had a very direct influence on the progress of events; and his appointment in 1869 as first president of the Tungwen College for training young men for the public service was the natural outcome of his literary labours. The chapters relating to this side of the author's life abound in life-like portraitures of the public men with whom he was necessarily more or less associated—Sir John Bowring, Sir Thomas Wade, Sir Harry Parkes, Sir Robert Hart, and others. A particularly interesting chapter is that on notable mandarins, including Li Hung Chang and the Marquis Tseng. The two chapters on China and her neighbours have a special importance at the present time, with Japan in the ascendency and Russia ever extending southwards. An appreciative account follows of Sir Robert Hart and the Chinese Customs Service, probably the only department of the Chinese Empire which is carried on on sound economic lines.

The plan of the book is autobiographical, and the sequence is in the main chronological. In Part I., which deals with Dr. Martin's earlier experiences in South China, and chiefly at Ningpo, we find a wealth of description of Chinese customs, superstitions, rituals, amusements, and vices. The opium question is discussed at some length, and one chapter ends with an account of the capture of Dr. Martin and his party by pirates, an adventure which might very easily have proved disastrous. A succinct history is given of the Taiping Rebellion, a movement which, had it ultimately succeeded, would have transformed the face of China. A bold, indeed foolhardy, attempt by Dr. Martin to penetrate to the Taiping camp at Nanking failed, and well it was that it did so. By that time the rebels, "flushed with victory and wild with fanaticism," were quite beyond any rational control.

The many-sided character and varied experiences of the author give to the *Cycle of Cathay* a unique place among the many descriptions of China and Chinese life. The interest of the narrative is well sustained throughout, and is further enhanced by the illustrations, some seventy in all, including portraits, sketches of

historic scenes and ceremonies, and photographs of various kinds. The map is clear but small; and many places are mentioned in the text of which there is no record in the map. This, however, is not very important in a book whose interest is ethnological rather than geographical.

De l'Alaï à l'Amou Daria. Par Félix de Rocca. Paris: Paul Ollendorff, 1896. Pp. vi+446.

This volume contains much information, pleasantly conveyed, both on the political aspects of the region described, and on its physical characteristics. Even the student of Central Asian history, familiar with the great and stirring drama of the Russian advance, may be glad to refresh his memory with this *résumé* of the invasion, as well as the more extended historical retrospect. The description of the various races inhabiting the country, and the details of the Russian administrative system, which are given very fully, but with some little repetition, are also interesting. For his information on the working of the system, the author must necessarily have been dependent on his hosts, with whom very naturally he is in sympathy,—"the enemy" across the Amou, actual or prospective, being the Afghans and the English. The chief centre of opposition to Russian influence, besides the Mohammedan priesthood everywhere, is still the ancient Khanate of Khokand (or Cocane as our author writes it), with its memories of former extensive supremacy. But even in Bokhara-el-Sherif the people are represented as well affected to Russia, and almost pining for her direct rule; though at the same time we are told that they have not hitherto benefited either morally or intellectually by their intercourse with the Russians. The Transcaspian railway, which brings the traveller from civilisation into the heart of what was recently a centre of savagery and bigotry, is a splendid monument to the skill and energy of its builders. It seems but yesterday since Vambéry described the perils of the terrible desert of Kizil Kum, and few of his readers then anticipated its ever being crossed by a railway. But, as M. de Rocca shows, the journey still has its risks and formidable difficulties.

The author has a good deal to say on the architectural features of some of the towns, and we are glad to learn that under the Russian rule there is some supervision of the more important of the old buildings. These are of considerable antiquity and interest, even in such remote spots as Kulab, on the borders of the mountain province of Darwáz, where the excellent and civilised *cuisine* of the palace added an unexpected attraction.

Economically the all-important question of these regions is irrigation. It may be remembered how the capture of Samarkand by the Russians, giving them the control of the water of the Zerafshan river, placed Bokhara once for all entirely at their mercy. Since then the suffering of Bokhara, owing to increased irrigation on Russian territory, has become very severe, and it is proposed to draw a supply from the Amou at a cost of six million roubles. As the author points out, the irrigation resources from all the minor rivers, as the Murghab at Merv, and the Zerafshan, and the possible consequent increase of population, are very limited; and, besides that a general desiccation of the whole region may be going on, it is probable that the increasing cultivation here and there in the Pamir valleys may be affecting the volume of the Oxus. The author has some interesting remarks on the old geographical problem of the former course of this river. It would seem that, notwithstanding certain historical or traditional evidence of a course towards the Caspian, the more recent Russian authorities consider the Uzboi depression to mark rather the site of some dried-up lakes than a former channel of the river.

It is even said that the possibility of diversion towards the Caspian is a question of levels which has not yet been worked out. It might appear a more profitable scheme to sacrifice the river to purposes of irrigation. But for this and other matters of interest, we must refer our readers to the work itself, which, by the way, deserves a better map.

Mongolia and the Mongols: Results of a Journey in Mongolia, accomplished in the Years 1892-93. A. Pozdnieevym. Tom. I. (in Russian). St. Petersburg: Press of the Imp. Academy of Sciences, 1896. Pp. xxx + 696.

Several books on Mongolia and narratives of travel in the country have been written, but never one on the gigantic scale of this work now being published by the Russian Geographical Society. The first volume contains the diary of M. Pozdnieef during the year 1892, when he travelled through Northern Mongolia, visiting Urga, Uliassutai, Kobdo, and Kalgan. Three more volumes are promised. Vol. II. will contain the author's diary during his travels in Southern and South-Eastern Mongolia in the year 1893; the third will deal with the administrative organisation of Mongolia, and the military and economic condition of the people at the present time; and in the fourth Lamaism as established in the country will be described.

The author appears to have been thoroughly prepared for the task intrusted to him by the Geographical Society, and has in this volume collected a vast store of varied information.

To Kumassi with Scott. A Description of a Journey from Liverpool to Kumassi with the Ashanti Expedition, 1895-96. By George C. Musgrave. With Illustrations from sketches by H. C. Seppings Wright and Others. London: Wightman and Co., 1896. Pp. vi + 216.

Mr Musgrave would have acted wisely if he had made his narrative start from Cape Coast Castle, rather than from Liverpool. Between England and the Gold Coast, the ground—if that term may be applied to the ocean track—is familiar, the route having been described again and again, by pens even more deft and more competent than his. About the Canary Islands, the Peak of Teneriffe, Sierra Leone, and Liberia, he has nothing to tell that has not been told and retold many times. The real interest of Mr. Musgrave's story begins with the latter part of his third chapter, in which the events that led up to the expedition of 1895-96, and that made it necessary, are briefly sketched. The fourth chapter describes the Gold Coast, Cape Coast Castle, and the natives; but it is provokingly spun out with irrelevant digressions about the uselessness of foreign missions, and the sins of missionaries. In his fifth chapter the author at last gets the expedition started; but here again the narrative rambles and digresses in a painfully erratic way. The truth seems to be that the author has not had sufficient literary experience to qualify him for such a work as he has undertaken. His style is slipshod and clumsy, and is often ungrammatical. It cannot be denied that the book contains much interesting, and some novel, information; but it is deficient in method, in the sense of proportion, and most of all in literary touch. Mr Musgrave has no sympathy with the natives: they are "cowardly blackguards" and mere "brutes." This, for example, is his comment on the treatment which their princes receive in England:—

"The young kinglets that yearly come over to this country for education seem to move freely in superior circles of society, and they are specially patronised by moneyed nobodies, whose snobbish instincts revel in the fact of having a real live

prince in their train, though he comes from a stock of brutal niggers, that no person could see in their natural state without horror and disgust"—(p. 85).

This, of course, is mere vituperation. Then, what exact meaning does he attach to "*horrendum dictu*"? What, to "this ferreous *strata*"? And is his "teste-fly" our old friend the tsetse-fly of Livingstone, or a new species?

In and Beyond the Himalayas: A Record of Sport and Travel in the Abode of Snow. By S. J. Stone, late Deputy Inspector-General of Police, Western Circle, North-West Provinces of India. Illustrated by Charles Whymper. London and New York: Edwin Arnold, 1896. Pp. 330. *Price* 16*s.*

This is a very attractive sporting work, forming a detailed guide to the localities its author found to be the favourite haunts of Himalayan game. One can only hope that the information so laboriously and skilfully obtained, and thus generously placed at the disposal of the "gunning" public, may not lead to the early extinction of the species—at any rate in those districts. The book contains many interesting and valuable notes on the habits of the wild animals, and on the mountaineers who share these inhospitable regions with them, while the illustrations are excellent. By a strange oversight of the artist, however, the view of the Pangong lake (facing p. 202), shows a flock of gull-like birds, apparently feeding in the water, which (p. 196) is so salt that every living thing avoids it; the author says "there are no fish, and I never saw a bird." But this is a small matter, in no way detracting from the general merit of this most enjoyable record of travel and sport.

New South Wales. "The Mother Colony of the Australias." Edited by Frank Hutchinson. With Maps and Illustrations. Published by Authority. Sydney: Charles Potter, Government Printer, 1896. Pp. 369. *Price* 5*s.*

In little more than a human lifetime the rich colony of New South Wales has been evolved from a land of bush, prairie and desert, inhabited by savages. The magic wand of British enterprise has covered the land with flocks, brought its gold to the surface, built thriving cities, and laid a network of iron roads over the country, carrying its rich produce to the sea. A record of this marvellous progress, and of the present state of the country's resources, is the object of the present volume. The idea is a new one, and it is admirably worked out. It may be described as an official statement of the various assets of the colony—physical, political, commercial, and demographical. The numerous subjects comprised in such a stock-taking have been dealt with separately in thirty-seven sections, each treated of by competent specialists, and embodying the most recent official statistics. Such a method is indeed ideal, and insures the most reliable information. But if we realise that every material and moral interest of the colony is supposed to be reviewed in this one volume—from laws to fruit culture, and from wool to social conditions—it is plain that these subjects can be treated in no great detail, for that would imply, not a volume, but a library. The experience of experts has, however, enabled them to condense their information into a nutshell, without omitting anything of consequence. This is the characteristic of the work.

Such a compendium, besides being of great value to all outsiders desiring information about the colony, must be of even greater value to the colonists themselves. They are enabled to realise their progress and actual position at the present time. Their past experience is summed up, and in the study of it they ought to find much guidance for future development.

Entstehung und Geschichte des Todten Meeres: ein Beitrag zur Geologie Palästinas Dr. Max Blanckenhorn. Leipzig: K. Bædeker, 1896.

This interesting essay is a reprint from the *Journal* of the German Society for the Exploration of Palestine. Dr. Blanckenhorn discusses first the geological conditions that obtained in that region before the Jordan depression had come into existence. The rocks consist in ascending series of—(*a*) a basal system of ancient crystalline schists and igneous rocks; (*b*) sandstones, which are either of Carboniferous or Permian age; (*c*) sandstones, limestone, and chalk-marl, of Upper Cretaceous age; (*d*) Quaternary or Pleistocene deposits. After the disappearance of the sea in which the Cretaceous strata were accumulated, Palestine formed part of an extensive plateau or table-land which had become more or less deeply incised by streams and rivers, and had suffered generally great denudation before the close of the Tertiary period.

At the close of that period, or very early in Pleistocene times, the plateau was fissured and fractured, and a series of parallel *faults* and *flexures* were developed along a narrow zone or belt extending from the Gulf of Akabah (Red Sea) north to the Lebanon mountains. The ground between these flexures and faults sank down unequally, the result being the formation of the great depression of the Dead Sea and the Jordan valley. The author then describes the Quaternary deposits which occur within the sunken area, and shows that there is evidence of the whole region having experienced three rainy epochs, separated the one from the other by epochs of dry climatic conditions. The rainy epochs are represented by alluvial terraces, with fresh-water organisms, which occur at different levels above the surface of the Dead Sea; while the dry epochs are indicated by alluvia containing beds and layers of salt and gypsum. Dr. Blanckenhorn thinks it is highly probable that the alternating rainy and dry epochs of Palestine were contemporaneous with the glacial and interglacial epochs of Europe.

Die Geologie der deutschen Schutzgebiete in Afrika. Dr. E. Freiherr Stromer v. Reichenbach. München u. Leipzig: R. Oldenbourg, 1896.

In this useful work we have an intelligent compilation of all that is known as to the minerals, rocks, and geological structure of the German possessions in Africa. The author gives also a very complete bibliography, so that students will know where to look for more detailed information. Probably most readers, however, will be content with the fare provided for them by Dr. Stromer, who has not been content with providing mere summaries of the contents of many separate papers and essays, but has discussed general questions relating to the geology of Africa in a highly satisfactory manner.

Thomas Chalmers. By W. Garden Blaikie. (Famous Scots Series.) Edinburgh and London: Oliphant, Anderson, and Ferrier, n.d. Pp. 160. *Price* 1*s.* 6*d.*

Professor Blaikie has given a sketch of the life of Chalmers in a very few pages, choosing out those events which were of real importance. The subject is, of course, quite outside the sphere of geography, and therefore we can only give the book a general recommendation.

Aarbog for Dansk Kulturhistorie. Udgiven af Poul Bjerge. Aarhus: Jydsk Forlags-Forretning, 1896. Pp. 203. *Price* 2 *Kr.*

As usual, the year-book contains several interesting papers giving a glimpse of the social and economic life of Denmark in past times. In *Skovbrug i gamle Dage,*

by P. Jensen, we have details on the distribution of forests in a part of South Funen and their exploitation two centuries ago, while the editor contributes a paper on *De Sönderskov Bönder*, in which the disputes of the peasants with the lord of the manor, with regard to the services to be rendered for their holdings, are set forth from documents; and other papers illustrate vividly the manners of old Denmark. These volumes are of permanent value, and the authors have done good service in rescuing from oblivion the information they contain.

The Statesman's Year-Book. Statistical and Historical Annual of the States of the World for the Year 1897. Edited by J. Scott Keltie, Secretary to the Royal Geographical Society, with the assistance of I. P. A. Renwick, M.A., LL.B. London: Macmillan and Co., 1897. Pp. xxxv + 1167.

The most striking feature in the new issue is a set of maps showing the political divisions of the world in the year 1837, at the accession of Queen Victoria, and at the present time. Tables are also added exhibiting the progress that has been made in certain directions during the reign of Her Majesty.

In other respects the alterations in the text are, as a rule, such as are annually needed in consequence of the constant fluctuations of commerce, shipping, etc. etc. In a few cases they are due to the results of recent censuses and to other new information. The work has been edited with the usual care and thoroughness.

A. Hartleben's Kleines Statistisches Taschenbuch über alle Länder der Erde. 4ter Jahrgang, 1897. Nach den neuesten Angaben bearbeitet von Professor Dr. Friedrich Umlauft. Wien, etc.: A. Hartleben's Verlag.

We have noticed this useful little book in former years, and therefore need say little about it, except that the statistics have been carefully brought up to date. As usual, the greater part of the information it contains is also published in a sheet which may be hung on the wall.

Italy: Handbook for Travellers. By Karl Baedeker. Second Part. *Central Italy and Rome.* Twelfth Revised Edition. Leipzic: Karl Bædeker, 1897.

The compiler of these excellent Guides is always endeavouring to improve them. Each new edition contains the small alterations needed to bring the work up to date, and new or improved maps and plans are given. It is in the latter direction that the most marked additions to the late editions have been made, while the letterpress has, wisely, been but slightly increased; it is more perfect without being more bulky.

Geography of Africa. By Edward Heawood, M.A. London: Macmillan and Co., 1896. Pp. 250. Index and Illustrations. *Price* 2*s.* 6*d.*

In writing this text-book, the author has followed two main principles. In the first place, the rule laid down by Dr. Mill in the general geography of Macmillan's geographical series, viz., of proceeding from the general to the particular, has been adhered to; and secondly, a clear understanding of the broad features of each region described has been taken as the necessary basis on which to build up the complete picture of such a region as the sphere of human activity.

Mr. Heawood has been very successful in adhering to his principles, and an excellent text-book has resulted, in which all the necessary information concerning Africa has been brought together briefly yet comprehensively, full of detail and yet readable.

The book will doubtless meet with wide success.

NEW MAPS.

EUROPE.

HULL, Plan of ——. Reduced Ordnance Survey Maps for Tourists. By. J. Bartholomew, F.R.G.S. *Price* 1*s*.

W. H. Smith and Son, London.

ITALY. Carta delle Strade Ferrate Italiane, 1897. Scala di 1 : 1,500,000.

Carta della Pianta di Roma. Edizione 1896. Scala di 1 : 8000.

Tavole Grafiche, Dimostrazione dello Stato dei Lavori Catastali dello Regno al 31 Ottobre, 1896 ——. Compartimenti di Milano, Firenze (Circolo di Cagliari), e Napoli (Circolo di Palermo).

Istituto Cartografico Italiano.

TURKEY. Map to illustrate the Cretan Question. *Price* 2*s*.

W. and A. K. Johnston, Edinburgh.

A simple map of the Turkish Empire, with insets showing the Sea of Marmora and Crete, which are studded with a large number of place-names.

AFRICA.

MASSAUA—ADUA—CASSALA, Schizzo dimostrativo della Regione compresa tra ——. Scala di 1 : 333,000. 2 sheets.

GUERRA ITALO-ABISSINA, Schizzo del Teatro della ——. Scala di 1 : 333,000.

GUERRA NEL SUDAN EGIZIANO, Carta del Teatro della ——, tratta dalle migliori e pui recenti Carte Militari Inglesi. Scala di 1 : 2,000,000.

Istituto Cartografico Italiano.

The works of the Istituto are marked by great care in the compilation and clearness of execution. The above maps are exceedingly useful to any one requiring information on the topography of the countries represented.

MARUTSE, Map of Part of the Kingdom of ——. From Surveys and Explorations by Captain Alfred St. Hill Gibbons, Mr. Percy C. Reid, and Captain Bertrand, 1895-1896. Scale 1 : 1,000,000.

The Geographical Journal, February 1897.

SHIRÉ HIGHLANDS (British Central Africa Protectorate), A map of the ——. By O. L. Beringer, Assoc. M. Inst. C.E. Scale $\frac{1}{2}$-inch to one mile. 2 sheets.

Edward Stanford, London, 1897.

An excellent map of the country east of the Shiré from the northern end of Lake Shirwa down to Chiromo. The hills are contoured, without colours, and roads, etc., are clearly marked. The printing is sharp and distinct.

POLAR REGIONS.

POLARGEBIETE, Die Grenzen der unbekannten ——. Von Prof. Dr. A. Supau. Breitenmassstab 1 : 20,000,000. Nebenkarten : Arktisches Gebiet bekannt am Ende des 18. Jahrhunderts, und Forschungsgebiet des 19. Jahrhunderts ——. Antarktisches Gebiet bekannt am Ende des 18. Jahrhunderts und Forschungsgebiet des 19. Jahrhunderts.

Petermanns Mitteilungen, 1897, *Tafel* 3.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

SOME RESULTS OF THE NORWEGIAN ARCTIC EXPEDITION,[1] 1893-96.

By Dr. Fridtjof Nansen.

(With Map.)

It might seem desirable to lay before the readers of this Journal a full survey of the additions to our knowledge of the northern regions and their physical conditions acquired during the three years we spent there. But the material we brought home is so abundant, that a long time must elapse before it can be put into shape by the various specialists. It is obvious that only after such preparation will it be possible to give any reliable account of the results themselves and of their scope. An attempt to give some of these results now would undoubtedly be to run the risk of making many errors, of giving a false impression of what the expedition has contributed to science, and, in addition, the survey itself would be very far from complete. But the Geographical Society of London may rightly expect to hear something of the outcome, and so I must give the little I am able, though on the express understanding that this is only a provisional account, which has no pretension to be other than a vague delineation of some few of the results and investigations which, at the moment, seem likely to prove of importance. I will begin with that branch of science with which this Society is particularly concerned—that is to say, geography.

When due regard is taken to the manner in which this expedition was planned and carried out, it is not in the nature of things to expect that any great geographical discovery, as the term is understood, would

[1] Published by permission of the Royal Geographical Society.

be the result. Our expedition was designed to be a sea-expedition pure and simple, which was to drift with the drift-ice and, rather than otherwise, keep clear of all land. The discovery of new lands can therefore hardly be said to have been our object, and we were fortunate enough, I had almost said, not to discover any. I say fortunate, for the reason that such new lands might easily have prevented the successful issue of the expedition, as they would have stopped the drift of the ice. But negative results are also a gain, and I think I may say that the expedition has contributed not a little to the increase of our knowledge of the distribution of land and sea in the regions nearest the Pole.

Before entering further on this subject, I will, however, first dwell shortly on some small changes in the configuration of the coasts along which we travelled. The first and foremost of these was the coast of Asia, where we made some discoveries of minor importance. In the Kara sea we discovered an island which, after its discoverer, was called Sverdrup Island. Along the coast of Asia we discovered several new islands and groups of islands. We landed on the Kjellman Islands, discovered by Nordenskiöld, and made various observations of interest regarding their appearance and extent. North-east of these we found a group we called Scott Hansen Islands; north-east of these, again, lie Clements Markham Islands; north of them are the Ringnaes Islands; thence north-east are Mohn Islands; and east of some others, and nearer the coast, lie the General von Tillo Islands. When we arrived at Taimyr Island, which was visited by Nordenskiöld, we made a discovery of greater importance. We found that our way was barred by land-fast unbroken ice. As will be remembered, there are, according to Nordenskiöld's chart, on the north side of this island, due north of Cape Laptef, three or four islands only, and these he called Almqvist Islands. We thought, therefore, that it would be an easy matter to find a way outside them; but to our astonishment, we continually found new islands stretching farther and farther north, and when we at last reached their northern extremity, there was still no passage; the ice lay close in to the coasts. They appeared to be an extensive group of islands, and for a long time I was in doubt as to whether what we had on our east was a large continuous land or several islands of lesser extent, as wherever I turned the glass inwards I saw land. The weather, however, was so thick that one could not see far, and I am inclined to think that they are a large group of islands lying at the northern end of Taimyr Island.

I have called them after the man who showed us the way along the coast of Asia, the discoverer of the north-west passage—they bear the name of Nordenskiöld's Islands. I am, however, inclined to believe that this group has already been discovered, and, indeed, by the Russian Laptef, who travelled along the coast in sledges, and took it for one continuous island, and that in reality they are the same as that marked on the older Russian charts as Taimyr Island, which is separated from the mainland by a broad sound. The latitude also seems to agree with this, although the most northern islands in our group are situated a good way north of the Taimyr Island of the Russian chart.

I think, then, that the Taimyr Island found by Nordenskiöld was in reality taken by Laptef to be the mainland, and that the Taimyr Sound supposed to have been found by him is, in point of fact, a new discovery. It seems very reasonable to suppose that a sound as narrow and crooked as this one, which one cannot see right through, would not have been discovered by persons passing quickly by, especially when travelling in sledges. When we were there, I could not myself, even from the crow's-nest on the main-mast of the *Fram*, clearly discern what it was, as it looked like a small closed-in fjord. It seems inconceivable to me that any one, even had he really discovered the sound, could have marked it on the chart as the broad strait we find between Taimyr Island and the mainland on the Russian charts.

Being stopped at the north end of this group of islands, we were constrained to turn back again and make an attempt farther south. We hoped for a way through Nordenskiöld's Taimyr Sound. There, however, progress seemed somewhat difficult, and we lay-to for several days to investigate the sound further before daring to penetrate into it with the *Fram*. There, too, we made several discoveries, finding the land indented by fjords and sounds, and with many islands outside. At last, on September 6th, a gale broke up the ice, and we were able to get past Cape Laptef and into Taimyr Bay. Great, however, was our astonishment to meet here, halfway down the bay according to the old charts, low sandy land stretching out like a broad tongue into the Taimyr sea.

I called this tongue of land King Oscar's Peninsula. In what manner it trends southwards we naturally could not determine for more than a very short distance, and I have therefore tried to unite it as well as I could with the coast about the mouth of the Taimyr river farther south, as indicated by earlier charts, which one may suppose to be fairly correctly placed.

On the east side of this tongue of land, as will be seen by the charts, a shallow bay runs into the land, which we called Toll's Bay. A little farther north we found a deep fjord, which penetrated inland as far as I could see, and which was probably the mouth of a good-sized river. The coast of the whole of the Chelyuskin peninsula northwards is very low, while inland we observed fairly high mountain ridges, partly covered with snow, and on some, I am almost inclined to think, there were small glaciers. Near Cape Chelyuskin itself there was a table-mountain (Mount Eivind Astrup) of medium height, which appeared to consist of some kind or other of sedimentary rock. On the west side of Cape Chelyuskin we found two small groups of islands—Fearnley's Islands and Axel Heiberg's Islands. Farther east there also seemed to be some small changes to be made in trend of the coast-line. Thus the north-east corner of the Chelyuskin peninsula appeared to stretch somewhat farther north than it is usually marked; while the coast east of Thaddeus Inlet, and the islands Peter and Paul, lay somewhat more to the south, as our course lay directly over their position, and yet we did not see them. I will not, however, dwell longer on these less important matters.

Without comparison, the most important geographical discovery made during our voyage was that concerning the Polar basin itself. This had

hitherto generally been considered to be a shallow sea,[1] where islands and land might be expected in any part. This was pointed out in this Society during the discussion that took place before my departure. The reason of the assumption was that, so far as the sea had been examined, it was everywhere shallow. In the sea south of Franz Josef Land and Spitzbergen there was a depth of as much as 160 fathoms, while along the coast of Siberia not more than 40, at most 80, fathoms had been found. Then, the expeditions which had penetrated northwards into this sea had always discovered new land; the Austro-Hungarian *Tegetthoff* expedition discovered Franz Josef Land during its drift, and the *Jeannette* expedition discovered Henrietta Island, Jeannette Island, and Bennett Island. In the plan I set forth of my expedition, I urged the possibility that a deeper channel might run across the unknown Polar basin, uniting the Atlantic Ocean with the tract where the *Jeannette* had drifted; I drew attention to the fact that the sea stretching northwards between Spitzbergen and Greenland was very deep—down to 2600 fathoms—and, on the other side, that the *Jeannette* seems to have found an increase in the depth northwards, or possibly only a narrow channel of water 80 fathoms deep, flanked by depths of 40 fathoms or less; and I then thought that these facts might possibly be connected with each other. I had, however, imagined the Polar basin, taken as a whole, to be shallow. We found great depths, the sea in lat. 79° N., north of the New Siberian islands, suddenly becoming deeper and sinking to a depth of 1800 to 2000 fathoms, and this depth was preserved during the entire drift of the *Fram* north-west and west, as far as north of Spitzbergen. It is my opinion, then, that not only does such a channel exist, as I had surmised, but that we must take it for granted that the Polar basin, considered as a whole, is a deep sea which forms a continuation northwards and eastwards of the same depth as the northern part of the Atlantic Ocean. How far this deep sea extends to the east it is difficult to form any opinion; we know now that it goes as far as to the north of the New Siberian Islands, but it is only reasonable to suppose that it extends still farther east, since, in the case of the *Jeannette*, every time the drift set her northward or north-eastward, the depth of the sea was found to increase.

What, then, is it reasonable to suppose with regard to the distribution of land and sea in the yet unknown Polar sea? I think we may with safety say that little or no land can lie on this side of the Pole, as, in the first place, it is not reasonable to suppose that such a deep sea can be only a narrow channel. It appears to me to be of too long extent for this, and on this account alone I should be inclined to think that it extends a good way north of that part of the sea traversed by us. Besides, we saw no indication whatever of land in any direction. During our sledge-journey north of the *Fram's* route, the ice appeared to be

[1] Not all authorities were of this opinion, however; twenty years ago Sir Clements Markham maintained that there was deep water to the north of Franz Josef Land, as will be mentioned later.

drifting with great speed—even greater than that of the ice we found farther south. There was a great deal of movement in the lanes, and at various times we were carried away in different directions with some rapidity—so rapidly, in fact, that it sometimes seemed as if we had been given up, helpless, to the violence of the wind and current. Masses of ice like those could hardly move with such great freedom in different directions, if land of any extent were in the vicinity, as this would present insurmountable obstacles to the drift. It ought also to be remembered that this was particularly the case every time the wind carried us in a northerly or north-westerly direction, but that, on the other hand, the drift seemed to be unusually sluggish every time we were set back towards the south-east.

A good index, with regard to how far tracts of land of any extent are to be assumed farther north, we shall certainly find in our meteorological observations; the course of the isotherms and the distribution of the atmospherical pressure, the directions of the wind, etc., must tell us something of the matter. Unfortunately, this important material is still in so rough a state that I will reserve all mention of it till some future date. I will only for the present remark that, from these data, I have not hitherto been able to find any indication of tracts of land north of us. There is, moreover, another thing which causes me to think that we are right in supposing the Polar sea to be of greater extent north of our route, and that is the drift-ice itself. If the *Fram* had continued her drift in the ice, instead of working herself out of it north of 83° N., there is no room for doubt but that she would have been carried southwards to the vicinity of the east coast of Greenland. She would have come towards known waters with the drift-ice which is carried down by the East Greenland Polar current, and which we know so well from Scoresby's description of it. It is the same drift-ice which we struggled with for three years.

It is not, however, reasonable to suppose that the *Fram* would have drifted in close under the east coast of Greenland; she would undoubtedly have had a broad belt of ice between her and the coast, and the ice composing this belt must, it goes without saying, proceed from a part of the Polar sea which lay to the north of us during our drift, and which may be of fairly large extent. If, for instance, we look at the relation between the Polar sea itself and its masses of ice, and the East Greenland Polar current and the continual transport of ice, it must occur to us to compare these relations with those which exist between a vast expanse of inland ice and its ejection through a narrow ice-valley, such, for instance, as we find in the ice-fjords of Greenland.

In the inner Polar basin, where the *Fram* drifted, the ice, as in the inner parts of the inland ice, was very slow in its movement. By degrees, however, as it approaches its outlet, the movement augments, the ice streams off with greater and greater speed southwards, until it at last comes to warm water, where it is broken up by waves and wind, and melts away. It is in the same manner that the offshoots of the inland ice stream out through the ice-valleys and the ice-fjords and down into the warmer strata of air, there to melt and emerge into

the sea, where, broken off, they float away in the form of icebergs. A certain breadth of ice-belt in the Polar stream of the east coast of Greenland must consequently answer to considerably broader and more extended parts in the known or unknown Polar sea. I think, consequently, that we may with certainty conclude that on this side of the Pole there is an extensive ice-covered sea. There is, on the contrary, a possibility of the existence of land of some extent on the other side. It is hardly reasonable to suppose that at this moment the northern confines of the American Arctic archipelago have been reached. We expect to find islands, perhaps islands of some importance, north of the boundary known at present. A closer examination of these parts, we must hope, will be undertaken in a not far distant future.

Before I conclude this short summary of the geographical results of the expedition, I must touch on a point which may be of some importance, and this is the character and extent of Franz Josef Land. During the drift of the *Fram* it was found, as before mentioned, that to the north of Franz Josef Land there lies a deep sea, and that this country can have no such extension northwards as has been surmised in several quarters. The discoveries made during my sledge-journey over the ice with Johansen serve only the more to corroborate this statement. The discoveries we made here may not seem overwhelming to some people; for already twenty years ago the President of this Society, Clements Markham, said, "Franz Josef Land seems to be a part of the Spitzbergen group, rising out of the same shallow sea, with deeper water to the north."

The opinion thus expressed was then somewhat novel, and aroused some contradiction at a time when it was customary to consider Franz Josef Land as the south coast of an extensive mass of land. I can now, after having myself explored part of this "deeper water to the north," give this opinion my full and entire concurrence. When I addressed this Society before my departure, I maintained that Franz Josef Land was not an eligible point of departure for an expedition to the Pole, if the object were to press forward overland, seeing that I regarded Franz Josef Land as merely "a group of islands." Our expedition seems to corroborate this. Franz Josef Land not only proves now to be a group of islands, but a group of comparatively very small islands. How far they extend to the northward we cannot yet determine with precision, but, in any case, their extent in this direction cannot be of importance. Petermann's Land cannot be of any great size, for otherwise we must have seen it when we went southwards in the summer of 1895.

That Oscar Land, also, is of no great extent, I think I may conclude from the fact that the ice on the north coast outside our winter quarters appeared to drift unhindered from the land towards the north every time a southerly gale sprang up. If there had been land of any extent in that direction—that is to say, where Oscar Land should lie—it would assuredly have hindered the drift of this ice. Of the extent of the land in an easterly direction, it is difficult at present to form any opinion. When we came west from Hvidten Land—the first islands discovered by

us—and perceived the chain of islands to the west and south, they stretched like an apparently continuous coast, here and there only divided by small sounds and fjords. The southernmost land that we saw was Wilczek Land, which, however, seemed to bend off in a south-easterly direction, and we saw no land farther east. On the other hand, there were signs in the sky denoting a considerable quantity of open water. That there really are islands in that direction, however, seems possible from the fact that, when we were encamped, during June and July, in about lat. 85° 5′ N. and long. 63° to 64° E., where we lay for a month, waiting for the deep snow to melt in order that our progress southward might be easier, we had, several times during the month, long periods of strong northerly wind, which were, however, unable to drive us farther south, although the ice seemed to move tolerably unhindered in other directions. This might indicate that there was a wall of land to the south of us, running east and west, and stopping the drift of the ice.

I think it is probable that the group of islands of which Franz Josef Land consists extends very much farther west than we now know, since, in the first place, neither Jackson nor we saw the limits of the land westwards on the north side of Alexandra Land. In point of fact, we discovered new islands in the west as far as our range of vision admitted, and, to judge by the large open land-lane which ran in that direction, one might suppose that the land there was of considerable extent. On the south side of Alexandra Land, Leigh Smith, equally with Jackson, failed to find the western limits of the land. Set this beside the fact of the new land discovered by the Norwegian sealers on the east side of North-East Land, the so-called White Island or New Iceland, which is probably the same as the mystical Gillies Land, and it becomes reasonable to suppose that a continuous chain of islands connects Franz Josef Land with Spitzbergen, which in such a case would be so closely continuous that it would be difficult to say where the one group of islands ends and the other begins. On this point, too, Clements Markham's words, that "Franz Josef Land seems to be a part of the Spitzbergen group" hold good. The geological structure of Franz Josef Land seems also to indicate that this is actually the case, and it is my intention to touch on this point directly. In those parts which Johansen and I should have visited had we not fallen in with Jackson, the Jackson-Harmsworth expedition will no doubt have many interesting discoveries to make.

Before I leave the geography of Franz Josef Land, I have a few words to say relative to the map.

I will first mention a discrepancy between our experiences and Payer's map, a discrepancy which has been the subject of a good deal of discussion, and perhaps also of misunderstandings. It was this discrepancy which brought us to think that the land we met with could not be the Franz Josef Land visited by Payer. It was our opinion, therefore, that our watches must be altogether wrong, and that we had come to a land much farther west—either the west coast of Franz Josef Land, or more correctly Alexandra Land, or perhaps Gillies Land, or some other new land situated between Franz Josef Land and

Spitzbergen. Where Payer placed the north end of Dove glacier and the north end of Wilczek Land, we found only sea, with the exception of the four islands which I named Hvidten Land. Of Payer's Rawlinson Sound we saw nothing, nor the north end of Austria Sound, and his Wilczek Land shrinks to a smallish island, the northern extremity of which lies about one degree farther south than he placed it. I could hardly conceive such a mistake, seeing that the land lay comparatively near his route, and therefore did not for a moment suppose that his map was incorrect, but rather that our watches were wrong. It was only after we had met Jackson and compared our watches, that I discovered that such must really be the case.

I have thought much as to how this error can have arisen, particularly as Payer's map, on the whole, is so carefully drawn, and, in my opinion, satisfies all the demands which can be made on a map prepared by a man travelling so quickly through the country. Dr. Copeland is now engaged in working on Payer's abundant materials, and, through the kindness of the former, I have been enabled to convince myself of their unusual reliability. I have also seen Payer's sketches, and have been able, through them, to recognise several of the lands seen and visited by us. I think that, by a comparison of Payer's and our observations, some more exact idea of the northern configuration of this group of islands could be arrived at. When one looks at Payer's sketches and reads his description of his journey northwards towards Crown Prince Rudolph's Land, one receives the impression that it must be easy to make the mistake alluded to, and which was destined to be so fateful for us. It arose, namely, from the circumstance that during the greater part of the time he was there he had fog and thick weather, and he says himself that he was under the impression that Wilczek Land ended a little way north of 81° N., just as it does in reality; but one clear day (April 7) he was led to take a different view. As he himself writes, "When the sun scattered the driving mist, we saw the glittering ranges of its enormous glaciers—the Dove glaciers—shining down on us. Towards the north-east we could trace land trending to a cape lying in the grey distance—Cape Buda-Pesth, as it was afterwards called. The prospect thus opened to us of a vast glacier-land conflicted with the general impression we had formed of the resemblance between the newly discovered region and Spitzbergen."

What Payer really saw here were, I think, banks of mist on which the sun was shining, and which on such occasions can have a misleading resemblance to glaciers—a fact which we often had occasion to notice during our journey. These banks of mist extended northward from Wilczek Land over Hvidten Land, and so onwards towards Prince Rudolph's Land. Perhaps, too, Payer did really see the top of the glacier on the largest of the islands of Hvidten Land—the upper one, which I called Eva Island; then, too, he probably saw the nearest of these islands, and has marked it by the name of Freeden Insel.

I can understand all the more easily that such a mistake may arise, since I was very nearly guilty of the same thing myself, seeing that as I came southwards through the sound discovered by Jackson—

the British Channel—along the west coast of Hooker Island, I thought all the while that we had a vast continuous glacier-land on our west. It was only when the mist lifted and it cleared on the evening of June 11, that we discovered the broad sound which lies between Northbrook Island and Bruce Island on one side, and Alexandra Land with Peterhead on the other. Had not this happened, and had we been constrained to make a map of these parts without receiving later information, I should have been guilty of exactly the same mistake as Payer made farther north, and thus I do not reproach him in any way.

Between our observations and Jackson's map of the land observed by him there are but few discrepancies to be mentioned here. The most important, perhaps, is that the land which Jackson saw to the north, and which he supposed to be King Oscar Land, is in reality some small islands lying west of our winter hut, some 40′ farther south; we saw them not far from us the whole winter. Jackson, however, expressly states on his map that it was the "approximate position, very misty, distance uncertain, and single bearings"; and when he saw my map he agreed that the land he had seen must be our three islands, for which reason I have not given them any name. The alteration in the position of this land makes it necessary, however, to move Queen Victoria Sea, so called by Jackson, a little farther south. This open water, which was visited by him, as well as by us, and which we had the opportunity of seeing in course of formation during the winter, cannot, however, be regarded as an open sea; such a designation might easily lead to misconceptions, as this open water must rather be regarded as a land-lead, which, like all other land-leads, is formed and opened by a land-breeze, and is closed again by the wind blowing in-shore. This discovery of open water on the north side of the islands one was prepared for, as exactly the same thing occurred to Payer twenty-two years ago, for he found a sheet farther north, on the north side of Karl Alexander Land and the west side of Crown Prince Rudolph's Land.

The other minor discrepancies which Jackson's map shows compared with our observations are of so little moment that I will not even name them. With regard to the giving of names on my map, I will only observe here that when I found out that the land on which we had lived during the winter was divided by a sound from Karl Alexander Land,[1] lying north of it and so named by Payer, I asked Jackson if he had any objection to my calling it Frederick Jackson Island, as a slight

[1] It ought, perhaps, to be mentioned that we did not find the sound which, according to Payer's map, should separate Andrée Insel from Karl Alexander Land. On discussing this matter with Dr. Copeland, he told me that he could not find anything in Payer's material which indicated the existence of this sound. Payer's original sketch-map had no Andrée Island and no such sound, and Copeland believed, therefore, that Andrée Island and the sound were owing to a mistake made by the man who drew Payer's map after his return from his voyage.

By seeing Payer's sketches of Karl Alexander Land, I have been able to identify various promontories. In particular, I could easily recognise Cape Felder, which has a peculiar shape, and which Johansen and I visited on the night between August 16 and 17, 1895 (see *Farthest North*, vol. ii. pp. 310-312). I describe it in my diary as "a curious high ridge, as sharp as a knife-blade." There is also a photograph from this place in my book, vol. ii. facing p. 430.

token of our gratitude for his exceeding hospitality towards us, and to this he agreed. I have otherwise refrained from giving names to any of the physical features which Jackson saw before we did.

The island situated between Jackson Island and Karl Alexander Land I have permitted myself to call after Leigh Smith, as a slight acknowledgment of his important instrumentality in the mapping and investigation of this interesting group of islands. It is, in a measure, a continuation of the work begun by Leigh Smith which the Jackson-Harmsworth expedition has undertaken, and they have already accomplished work deserving of great credit. Jackson's map of the part of the group of islands which he has surveyed gives the idea of great accuracy. Thus, when I compared our observations with his map, I found that for the place where our winter hut was situated, which lies near his northernmost point, there was only a difference of some few minutes. It is particularly unfortunate, that, during the last two years, circumstances have prevented Jackson from travelling over a larger part of this group of islands. In the coming year, these difficulties will be surmounted, and we may expect an eminently satisfactory map of the whole extent of this interesting group of islands; one of the more important problems yet remaining in the sea on this side of the Pole will then be solved.

In concluding my remarks on the geographical discoveries made by us, it may, perhaps, be appropriate to add a few words on the geological character of the countries we visited. The geological investigations we were in a position to make during our voyage along the coast of Asia were necessarily of very small extent, as our visits on shore were of an accidental nature and of extremely short duration. At no place where we landed did we find sedimentary deposits which were not metamorphosed. As a rule the rocks we met with *in situ* consisted of crystalline schists and granites; amongst these may be mentioned a characteristic aplitic muscovite granite from Cape Laptef. On the north-east corner of the Chelyuskin peninsula we observed a very finely grained hälleflinta, in its appearance resembling quartzite.

Of more importance were the indications of an ice-period which I believe to have found in several places on the north coast of Siberia. The undulating tundra of Yalmal, consisting of sand, clay, and small stones (boulders), reminded me of the North German plains, and suggested the idea of a vast ground moraine (till). It was full of round depressions and lakes, which reminded me of the North German lakes, and those so often to be seen on extensive ground moraines. We found, however, no large erratic blocks on these tundras, and our investigations were of such a slight character, that I dare not at present pronounce any certain opinion as to the glaciation of this land. Farther north, indeed, I found unmistakable glacial marks. Thus, on the beach of one of the Kjellman Islands, where we landed, I found striated rock-surface of such a nature that it could not be explained in any other way than as produced by the scouring of glaciers. The drift-ice does indeed occasion scratches or striæ on the coasts, but this striation is necessarily somewhat superficial, and the scratches are extremely irregular in their direction.

The striæ I found here, on the contrary, were decided and deep, and ran parallel to each other in a definite direction. That I only found striæ of this kind on that part of the beach which is laid dry at low tide, is easily explained by the fact that the surface of the rocks in these regions is so weathered by the prevailing climate that, as a rule, all striation disappears very rapidly, the mountains being fissured and shattered in all directions by the frost.

Wherever we landed up here, the country was sown in all directions with larger or smaller boulders, and these, no doubt, were in some places of the same kind as the rocks *in situ*. In other places, however, I often found large blocks differing completely from the rock which formed the ground on which they lay. The land on the west side of the Chelyuskin peninsula, at the head of Toll Bay, where I went reindeer-shooting one day (September 8, 1893), had a thoroughly typical till-like appearance. It was a very undulating clay plain, over which was strewn a multitude of large boulders of different rocks, and their presence could hardly be explained except by the supposition that they had been brought thither by an extensive ice-sheet. The land, too, was of striking resemblance to the plains which are generally admitted to be glacial ground moraines. The fact that I found an indication of stratification in several places where the clay had fallen away—as, for instance, along the shore and in some stream-beds—can hardly be regarded any longer as an argument against its moraine-like character, as we know, for example, of several incontestable cases of moraines in the south of Norway which have distinct stratification. Even in terminal moraines, such a stratification is commonly found in Norway. It is only a proof that the moraine was formed under the surface of the sea.

It may be thought that the glacial traces we found might be due to local glacier formation; but if they be compared with what Toll found almost simultaneously with us on the New Siberian Islands and at the Anabara river, where he has pointed out most interesting remains of an ice-period, it must be conceded that the probability is that at any rate a considerable part of the north coast of Siberia must have been buried under an ice-sheet like that which in its time covered the whole of Northern Europe, and the exemption from an ice period, which has been assigned to Siberia, can no longer be maintained. The entire configuration of the Siberian coast also appears to indicate that it has had an ice-period, as outside it there lies a belt of rocks and islands such as very seldom occurs, except off glaciated coasts. Moreover, the coast itself, where we approached it, appeared to be much fringed everywhere with deep fjords, such as are seldom found in other than glaciated lands. I should imagine that the whole of the north-west coast is indented in a similar manner, and the impression given by the ordinary maps of a continuous even coast-line is therefore misleading.

The geological structure of Franz Josef Land is of a very peculiar nature. It appeared, wherever we visited it, to consist of basalts. In the northern parts of the islands these basalts and other plagioclase pyroxenic rocks reached the very shore, and I searched in vain for fossil-bearing strata. Farther south, however, near Cape Flora and thereabouts,

the basalt did not reach to the sea; but, as the Jackson expedition had already discovered, an immense formation of clay stretched from the shore up to an altitude of from 500 to 600 feet, and on this formation the basalt rested to a height of another 500 to 600 feet. I brought home with me a collection of specimens of basalt from the neighbourhood of Cape Flora, as well as from farther north. These have been examined microscopically by Professor Brögger. There is a great difference in the basalt in different parts. While in some places it has a decided porphyritic structure, thereby differing from many typical basalts more resembling many melaphyres, to a very great extent the basaltic lavas have an amygdaloidal structure. The cavities are filled with zeolites (especially analcime) and calcite: it is in other parts—at Cape M'Clintock, for example—very coarse-grained in quality, with diabase structure (doleritic structure), and appears to be closely connected with the diabases (dolerites) and basalts found in Spitzbergen, particularly on Stans Foreland and in the Stor Fjord, as intrusive sheets. The basic rocks of Franz Josef Land seem to have been formed in the Jurassic period, for the clay formation on which they rest at Cape Flora is undoubtedly Mesozoic (Russian Jura, Lamberti-zone), and above the basalt were found, as I shall mention presently, fossil plants belonging to the later Jura period.

It thus appears that Franz Josef Land is, taken altogether, of Mesozoic (Jurassic) formation. The numerous flat basaltic streams, which extend over all the islands at about the same height, seem to tell us that at one time it was a continuous mass of land, which in the course of ages, eroded by various wasting forces, such as frost, moisture, snow, glaciers, and the sea, has become cut asunder and destroyed, and has partially disappeared under the surface of the sea, while only scattered islands and rocks now remain, separated from each other by sounds and fjords. These basalts have, as I mentioned before, a striking resemblance to those found in parts of Spitzbergen; like them, they contain very little olivine and iron ore, and it is probable that Franz Josef Land and Spitzbergen formed a continuous eruptive province, different in age and rocks from the great Tertiary eruptive province of North-Western Europe, the Færoe Islands, Iceland, Scotland, Ireland, and Greenland.

An interesting discovery was made while we were at Cape Flora, Jackson and the geologist of the English expedition, Dr. Koetlitz, finding one day, on a basalt mountain projecting from a glacier, numerous fossil plants. Another day Koetlitz and I went there together, and made a valuable collection of them. My comrade Johansen also found his way there one day on "ski," quite unwittingly, and also collected fossils, which he brought to me. These fossils have been examined, since our return, by Professor Nathorst, and it proves that Jackson and Koetlitz's find is a highly interesting one. Professor Nathorst has, in a letter, given me some preliminary information on the character of these fossil plants, and he says that, "in spite of their fragmentary character, the specimens of fossil plants brought home are of great interest, as we are enabled through them to get a glimpse, for the first time, into the plant-world which existed in the latter part of the Jura period in the tracts

north of 80° N." The leaves of a certain pine, closely connected with the *Pinus Nordenskiöldi* of the Jura strata of Spitzbergen, East Siberia and Japan, but probably belonging to a different species, are most common. There are also leaves of another kind, a fragment of a cone,[1] and several seed-vessels, of which one reminds us of the *P. maakiana* from the Jura strata of Siberia and Spitzbergen. Nathorst, in addition, mentions several other conifers, which, however, I will not touch upon here. Interesting, he says, is the appearance of the genus *Feildenia*, as it has hitherto only been known in the Polar regions. It was first found by Nordenskiöld, in 1869, in the Tertiary strata of Spitzbergen: afterwards by Feilden, in the Tertiary strata of Discovery Bay, in Grinnel Land, during the English Polar expedition of 1875-76. It has been found since by Nathorst in Spitzbergen, in the upper Jurassic strata.

The most beautiful in the whole collection are the leaves of a small *Ginkgo*, of which one is complete. This genus, with plum-like seed and with leaves which, unlike those of other conifers, have a real leaf-surface, is now found in Japan in a single species; but it appeared in earlier times in a multitude of forms, and was widely distributed. It was particularly luxuriant in East Siberia, in the Jura period, and it is also known from Spitzbergen and Eastern Greenland (near Scoreby's Sound), and many places in Europe, etc. A new kind, closely connected with Heer's *Gingko flabellata*, has been named by Dr. Nathorst *Gingko polaris*.

There are also fossils of several other conifers, which, however, I will not enumerate here. "On the whole," says Nathorst of this Jura flora of Franz Josef Land, "it is, by reason of its wealth of conifers, its poverty in ferns, and its lack of cycads (or, at any rate, great rarity of them), of about the same general character as the Upper Jura flora of Spitzbergen, although the species may differ; and it would seem that the flora does not testify to particularly favourable climatic conditions, although the interval between then and now is a vast one. The deposit presumably took place in the vicinity of a forest of conifers. As far as can be judged by the material, the flora belongs to the upper White Jura rather than to the middle Brown Jura."

I will conclude these remarks on the geological investigations with a few words on the present bottom-sediment of the Polar basin. By examining with the microscope the samples which we secured by our soundings, we found that they differ essentially from the samples taken from the North Atlantic Ocean, as they are wanting in the organic compounds and shells of marine animals which form such an important ingredient in the ground-mud of the North Atlantic Ocean. On examination with acids, it was also shown that this mud is particularly deficient in calcium carbonate, and seems to be chiefly of mineral components. There has not yet been time to subject these samples to very careful examination, and I will, therefore, for the present refrain altogether from

[1] Leigh Smith brought home a fossil cone from Franz Josef Land, which Carruthers decided to be that of a pine; but he supposed it to belong to the upper group of the Chalk system.

attempting any explanation of the characteristic composition of this miry matter. It appears that a deposit of sedimentary strata is now taking place in the Polar basin, which, however, may prove to be extremely deficient in fossils.

A very important result of the Norwegian Polar Expedition is the glimpse it has given us into the drift and transport of ice in the hitherto unknown Polar sea. As will be known to this Society, and as I pointed out before my departure, the plan of the expedition was based on the assumption that a current or continual drift of ice must go right across the Polar basin, from the sea north of Siberia and Bering Straits towards the sea between Spitzbergen and Greenland. It was with this ice that I intended to let the *Fram* drift. My assumption seemed to be at variance in several ways with the current ideas of the nature of the Polar sea. The expedition was, however, carried out in accordance with the plan: it has proved that the premises from which I started were more or less correct, and it has enabled us now to form a fairly complete picture of the manner in which the ice drifts ceaselessly across this basin.

Although, as I mentioned, the assumption of such a drift was at variance with current opinion, something of the kind had already been suggested in several quarters. I will mention the eminent chairman of the Royal Geographical Society, Clements Markham, who, in "The Report on the English Expedition of 1875-76," said, twenty years ago, that the water emptied from the rivers of Asia and America into the Polar basin "causes a current round the area from left to right, and also across from the eastern to the western hemisphere." As early as 1869 the Swedish naturalist, Professor Agardh, showed that the drift-wood of Spitzbergen originated in Siberia. Among the others who previously made investigations in the same direction, I must mention Professor Mohn, who, when the articles from the *Jeannette* were found in 1884 on the south-west coast of Greenland, pointed out that they must have drifted straight across the Polar basin north of Franz Josef Land and Spitzbergen, and down along the east coast of Greenland.

What caused me most of all to place reliance on a drift of this kind constantly moving across the Polar basin, and to think that it might be turned to account for the purposes of an expedition, as was done by us, was, first and foremost, the Siberian drift-wood which is constantly brought to the east coast of Greenland, as well as the earthy matter to be found everywhere on the drift-ice which comes down along that coast. A microscopic investigation of some mud which I had collected proved that it could not well proceed from anywhere else but from Siberia. During our journey we again found, ourselves, the same proofs of the origin of the ice; I found earthy matter on the ice as far north as 86° N., and drift-wood likewise. I remember one day far north, during my journey with Johansen over the ice, our astonishment at seeing a large piece of timber projecting from the ice; it hailed perhaps from the interior of Siberia, and was on its way to the Eskimo of Greenland. The only thing we could do was to cut our initials in it, with the date and latitude, in the hope that it might take

a greeting to some acquaintance away in Greenland. We often found similar drift-wood in the neighbourhood of the *Fram*. Sverdrup once found a half-rotten piece of timber which was firmly frozen into the ice —this was in April 1896. When, about a month later, he came across the log again, he was astonished to find that it had been broken off and dragged some distance away. The bears had, no doubt, been amusing themselves by exercising their strength.

But what causes the drift of the ice over this sea? First of all the winds. The prevailing winds blow from the Siberian sea towards the North Atlantic Ocean, and, in course of time, carry the ice over in that direction. But winds are, as we know, very irregular forces, and consequently the drift is not particularly regular. Sometimes there are stoppages, sometimes a return drift, sometimes even a drift sideways; but, on the whole, it proved that every time the wind carried us in the right direction—towards our goal—the drift became very rapid. On the other hand, if the winds came from the contrary direction, setting us back towards the south-east, the masses of ice were very sluggish and difficult to set in motion; it seemed as if something were keeping them back. As the prevailing winds change very much with the seasons of the year, our drift was also periodical.

As a rule the wind was most favourable in the winter; in the summer—particularly the latter part of the summer—it was generally unfavourable. No sooner were we fast in the ice the first autumn than we experienced an unfavourable period and were set back towards the New Siberian Islands; this was a very dark period in our drift, and everything seemed to go backwards. Then came the winter with good progress, but from June onwards to the autumn of the next year there was again retrograde movement. Then came another winter with good progress, and we gained a point north of 84° N. The summer following was not particularly favourable either, but the succeeding winter—it was the last winter—sent the *Fram* right north again to 86° N. Then came the spring with a long pause in the drift of the *Fram*, until she finally broke loose out of the ice as far north as above 83° N. and made her way down to Spitzbergen—a distance through which no vessel has hitherto broken its way through ice so massive as that which there surrounded her. But, according to my opinion, it is not merely changing winds which influence the drift of the ice; I thought, too, that at times there was evidence of a slight current in the water, under the ice, which also went in about the same direction. Nor do I think that the drift of the ice quite coincides with the direction of the prevailing winds. I had the impression that it often carried us a little farther north than the latter would have done; but our abundant material is not yet worked out, and until this is done it will not be possible to say anything for certain on the subject.

Our experience with regard to the drift provides a complete picture of how this ice is in continual motion: how there is not a single stationary spot on the whole of this great sea-surface covering the region around the Pole. From the whole of this area the winds and the current carry the ice out towards the openings which lead to the Atlantic Ocean, chiefly

through the large gap between Spitzbergen and Greenland, but also down through the narrower sounds between Greenland and the islands of the North American Archipelago. The massive ice-mantle with which so many of our great Polar explorers have sought to cover the Pole has disappeared. Instead of it, we have the ever-wandering ice-fields like a link in the eternal round of Nature.

Of the character, formation, and freezing of this ice, our expedition has gleaned valuable information. It would, however, lead me too far away to enter more fully on this subject, and I will confine myself to the mention of the thickness which the ice attains by direct freezing. As soon as the ice is formed it grows very rapidly, but as the thickness increases the growth becomes slower and slower, as the heat, which radiates outwards during the long winter night, has then more difficulty in escaping from the underside of the ice. The ice which was formed in October and November of the first autumn, 1893, had in April, 1894, attained a thickness of 2·31 mètres, but it continued to increase steadily during the summer. On June 9 it had reached a thickness of 2·58 mètres, and this in spite of the fact that there was already a severe thaw on the surface caused by the rays of the sun. On June 20 the thickness was still the same; the thaw on the surface was considerable, and there were large fresh-water pools in every direction. During the remainder of June the ice continued about the same, until on July 10 it suddenly received a new layer underneath, so that altogether it measured a thickness of 2·76 mètres, despite a decrease by thawing on the surface of several centimètres a day. For the layer of fresh water, derived from the surface thaw of the ice, floated upon the cold salt water, the temperature of which was considerably below the freezing-point of fresh water, and was so effectually cooled by the contact that at the line between the fresh and the salt water, at a depth of about 2·5 mètres, a thick layer of fresh-water ice was formed. The total thickness remained unchanged through the summer, but then began to decrease slowly, until in September it was about 2 mètres. The growth began again in October; on November 10 the thickness had become 2·08 mètres; on December 11, 2·11 mètres; and it continued to increase slowly during the winter. On February 6 the thickness was 2·59 mètres. During the spring the ice continued to grow; on May 11, 1895, it had become 3 mètres; and it was about the same on May 30, viz., 3·03 mètres.

It will thus be seen that the ice does not attain any excessive thickness by direct freezing, for this ice had made the journey from north of the New Siberian Islands to the sea north of Franz Josef Land, that is to say, across no inconsiderable part of the Polar basin. A floe which was measured the following winter, on November 4, 1895, was 3·36 mètres thick; it continued to grow thicker during the course of the winter; and on May 4, 1896, had reached 3·975 mètres—quite a respectable thickness when it is a case of forcing a ship into it. But much greater thickness is, of course, attained by constant upheaval from pressure, and it is the enormous piled-up hummocks and rubble caused thereby, coming down with the Polar current along the east coast of Greenland, which give this drift-ice its character.

The constant pressure to which the ice is subjected gave the expedition a good opportunity of making observations. It proved, as has already been found by several earlier expeditions, that the pressure is dependent in no small degree on the tidal current. This was particularly the case on the outer margin of the Polar basin in the proximity of the open sea. Thus, for example, the pressure in the ice during the first autumn, 1893, was so regularly dependent on the spring tides, that we could almost say beforehand when it was going to take place. We had two regular recurrences during the month—one period at new moon, when the greatest pressure took place; another period of less pressure at full moon. At these periods the pressure would recur twice during the twenty-four hours, and might be rather violent.

A similar, regular, tidal pressure was experienced by the *Fram* during the last spring and summer, when she had entered the sea north of Spitzbergen; it recurred at such regular intervals that, during one week in July, the *Fram* was twice a day gently and steadily lifted up, almost out of the water, by the ice, which then closed together again around her. The pressure was less regular in the interior of the Polar basin, particularly during the winter. It sometimes happened, for instance, that after the wind had been blowing for a long time from the south-east, and the ice had got into a good drift in the right direction, the wind changed suddenly, tending to drive the ice into other paths, when the latter would offer resistance by its inertia, and violent pressure ensued. The chief mass would come pressing onwards from behind, while other masses of ice farther in front were set in motion towards it. If the wind went over to the south-east again, the pressure would cease altogether. It was pressure of this kind to which the *Fram* was subjected at New Year, 1895, and which seemed to have the greatest desire to overwhelm her.

By this movement of the ice, occasioned partly by the tide, partly by the winds, seams and lanes are formed in it, which often run at right angles to the direction of the movement. These lanes often have a great extension, and form large lakes. When, then, pressure suddenly takes place, the ice at either side of these seams and lanes is forced together, the flows partly run under each other, are partly piled up in long ridges (*skrugarer*), which consequently assume a position at right angles to the direction of the movement. By degrees, as the direction changes, the new ridges cross and recross each other, until the whole surface of the ice is cut up into an intricate network of lanes and ridges, which make progress with sledges and dogs a very difficult matter, as Johansen and I experienced during our journey in 1895.

Investigations of the temperature and the various depths of the sea-water were made during the entire drift of the *Fram*. As is known, the water which floats from the East Greenland Polar current into the Atlantic Ocean is extremely cold to a great depth, and therefore the whole of the North Atlantic Ocean is filled with cold water from the Arctic Ocean of a temperature of $-1{\cdot}5^{\circ}$ C. It was, therefore, perhaps to be expected that a similar temperature would be found in the entire Polar basin from surface to bottom. I had, indeed, my daring

doubts of this beforehand, seeing that I assumed the Gulf Stream to enter this basin from several quarters, as I represented to this assembly before my departure, and I thought that a current of this kind must make its influence felt. Great, however, was my astonishment when, as far east even as the sea north of the New Siberian islands, I found undoubted traces of such a warm current. The surface-water of the entire Polar basin is, no doubt, very cold, seeing that it keeps to about the freezing-point of salt water, *i.e.* $-1{\cdot}5^\circ$ to $-1{\cdot}6^\circ$ C. When, however, I penetrated through this layer to a depth of 200 mètres, I suddenly came on warm water, the temperature of which would be as much as $+0{\cdot}5^\circ$ C., or even $+0{\cdot}8^\circ$ C. At a greater depth the temperature varied somewhat, but remained about the same down to 400 or 500 mètres, after which it sank slowly towards the depths, though without reaching the cold temperature of the surface-water. Near the bottom it again rose quite slowly. These conditions were fairly uniform in that part of the sea over which we travelled, and where investigations were made. If I, therefore, give one such series of temperatures from the surface to the bottom, it will be sufficient to characterise the conditions taken as a whole.

TEMPERATURE SERIES, TAKEN AUGUST 13-17, 1894.

Surface	$+1{\cdot}92^\circ$	450 mètres	$+0{\cdot}36^\circ$
2 mètres	$-1{\cdot}32^\circ$	500 „	$+0{\cdot}34^\circ$
20 „	$-1{\cdot}33^\circ$	600 „	$+0{\cdot}20^\circ$
40 „	$-1{\cdot}50^\circ$	700 „	$+0{\cdot}14^\circ$
60 „	$-1{\cdot}50^\circ$	800 „	$+0{\cdot}07^\circ$
80 „	$-1{\cdot}50^\circ$	900 „	$-0{\cdot}04^\circ$
100 „	$-1{\cdot}40^\circ$	1000 „	$-0{\cdot}10^\circ$
120 „	$-1{\cdot}24^\circ$	1200 „	$-0{\cdot}28^\circ$
140 „	$-0{\cdot}97^\circ$	1400 „	$-0{\cdot}34^\circ$
160 „	$-0{\cdot}58^\circ$	1600 „	$-0{\cdot}46^\circ$
180 „	$-0{\cdot}31^\circ$	1800 „	$-0{\cdot}60^\circ$
200 „	$-0{\cdot}03^\circ$	2000 „	$-0{\cdot}66^\circ$
220 „	$+0{\cdot}19^\circ$	2600 „	$-0{\cdot}74^\circ$
240 „	$+0{\cdot}20^\circ$	2900 „	$-0{\cdot}76^\circ$
260 „	$+0{\cdot}34^\circ$	3000 „	$-0{\cdot}73^\circ$
280 „	$+0{\cdot}42^\circ$	3400 „	$-0{\cdot}69^\circ$
300 „	$+0{\cdot}34^\circ$	3700 „	$-0{\cdot}65^\circ$
350 „	$+0{\cdot}44^\circ$	3800 „	$-0{\cdot}64^\circ$
400 „	$+0{\cdot}35^\circ$		

These water temperatures are remarkable in several ways. First, the temperature, as will be seen, sinks from the surface down to 80 mètres; it then rises till a depth of 280 mètres is reached; sinks again at 300 mètres, and again rises at 325 mètres (where it is $+0{\cdot}49^\circ$). It then sinks to rise again at 450 mètres, then sinks steadily down to 2900 mètres, and rises once more slowly towards the bottom. Similar risings and sinkings were found in nearly all the temperature series, and the variations from one month to another were so small that at the

different depths they often only amounted to a couple of hundredths of a degree. Sometimes, however, the temperature in the warm-water layers would rise even higher than is here given. Thus, on October 17, the temperature at a depth of 300 mètres was $+0{\cdot}85^{\circ}$, at 350 mètres $+0{\cdot}76^{\circ}$, at 400 mètres $+0{\cdot}78^{\circ}$, and at 500 mètres $+0{\cdot}62^{\circ}$, after which it sank gradually until towards the bottom it began to rise again as noted above.

I have now mentioned most of what it is possible for me to enter upon here. There is still a great deal which ought also to be noticed, but which does not lend itself to discussion at present, as the material must first be worked out. This is particularly the case with the meteorological observations, which, being extended over a period of three years, will afford a valuable contribution to the understanding of the climatic conditions of these regions. I can, nevertheless, say, that our observations did not bring to light any meteorological surprise, as did those on our expedition across the inland ice of Greenland. The temperature seems to be distributed over this sea in about the same manner as might be assumed beforehand; and when, in setting forth my plan of the expedition, I represented that the winter temperatures in the unknown Polar sea would probably be found to be higher than those of Siberia, for instance, I was correct. The sea seems to make its presence felt here, and our lowest temperature ($-52{\cdot}6^{\circ}$ C.) was not immoderately low, when it is remembered that in Verkhoiansk, in Siberia, which is inhabited by people, temperatures as low as -68° C. have been registered.

The weather in the winter up there was unusually clear, and often for a long time together there was not a cloud in the heavens. In the summer, when there were open lanes and the snow melted on the floes, there would, however, be much mist, even in the interior of the Polar basin. On the whole there seemed to be much equableness in this atmosphere, and the winds were not particularly strong: they seldom amounted to what we should call a gale here. This was most apparent in the eastern part of the Polar basin; but by degrees, as we approached the Atlantic and the parts between Spitzbergen and Greenland, there was a change in this respect, the winds sometimes blowing with much greater violence. There was, however, a conspicuous difference, on the whole, between the winds and the climate in the north, along the *Fram's* route in the drift-ice, and the climate which Johansen and I experienced during our winter in Franz Josef Land. While in the north, in the long still winter night, there had been a remarkable quiet and equableness, the reverse was then the case. Storms howled round us continually. Matters came to such a pass that one day the wind even carried away Johansen's kayak, and we nearly lost it altogether in the darkness. Another day my sledge went off. A third day a ski, which was standing up in the snow by the side of the hut, had the end blown right off; and although the temperature in Franz Josef Land was very much milder than that we had experienced north in the Polar basin, yet it cannot be denied that now and then we both longed for the profound stillness we had left behind.

We had unusually good opportunities of observing the northern lights, and they were exceedingly frequent. I think I may say that not a single night or day passed during the winters up there without the aurora being visible, provided the weather was clear enough. Furthermore, I must mention that it appeared to me that the sky was always covered by a faint, even veil of light, which, as far as my spectroscopic investigations could determine, seemed to be a constant aurora-veil. This veil was thick enough to almost hide the Milky Way, so that we could never discern it with certainty. On the whole I received the impression that the aurora-belt which surrounds the Pole extends, on this side, a good deal farther north than is generally supposed. I also made observations with regard to the electricity of the atmosphere. This seemed to vary very much, and at times was considerably greater than has generally been supposed; at other times it was very difficult to perceive any trace of electricity. Lieut. Scott-Hansen made a long and valuable series of magnetic observations during the three years we spent up there. It is to be hoped that, when this ample material has been worked out, it will yield valuable contributions to our knowledge of this difficult subject.

With regard to animal life in these parts, there is a good deal that is new to be related, which space, however, does not admit of. There were naturally numerous animals, particularly *Crustacea*, in the sea, even in the highest latitudes. As a remarkable fact in this connection, I must mention that even north of 84° N., and near 85° N., schools of narwhals were observed near the *Fram*—a proof that they must be able to find sufficient nourishment here. Seals were frequently seen in the summer, and the first winter I even came across a walrus in the middle of the sea between the New Siberian Islands and Franz Josef Land. What it was doing there is still a puzzle to me. Bears were shot on board the *Fram* north of 84° N., and Johansen and I saw the tracks of foxes in 85° N. It will be seen by this that even mammalian life exists very far north on our globe, and it may even reach the Pole itself. We saw birds every summer. I think I have made a very interesting discovery in the number of mysterious Ross's gulls, or pink gulls (*Rhodostethia rosea*), that we saw on the north side of Franz Josef Land, near the islands discovered by us, *i.e.* Hvidten Land. They were so common that I have no doubt whatever but that they have breeding-grounds in the neighbourhood. Unfortunately, time did not admit of our investigating this further. On board the *Fram*, too, we shot several quite young birds of this species in their hitherto unknown garb.

While speaking of animal life in the far north, I ought perhaps to mention the organisms I found in the summer in the pools on the drifting ice. As soon as the summer sun is able to melt the snow off the ice in these parts, a comparatively rich plant and animal life begins to develop in the fresh-water pools caused by the thaw on the surface of the ice. Brown patches and accumulations, that might easily be taken for dirt, reveal themselves under the microscope as purely organic—chiefly minute plants, diatoms, and some *algæ*. But among these there also exists a crowd of tiny microscopic animals—*Infusoria*—and I also discovered

small bacteria, so that even these regions are not free from this noxious animal. It is a remarkable proof, in my eyes, of the fruitfulness of Nature: even on the ice she finds conditions for the production of life.

Before concluding this paper I must point out what guidance the expedition may possibly afford in the future exploration of the regions of the Polar sea which are still unknown. First of all, I think, the expedition has clearly proved the efficiency of the mode of travel which we adopted. That a ship can be built able to withstand the pressure to which it is necessarily subjected on a drift through these regions, I think we have proved. It can hardly be doubted but that the *Fram* was exposed to difficulties of this kind as great as can reasonably be expected. Worse pressure than that we had in January, 1895, I, at any rate, have never heard of. The *Fram* was at that time beset in ice over 30 feet in thickness; the temperature was very low, so that the ice was about as hard as it could be, and during the pressure a prodigious ice floe overran the thick floe in which the *Fram* was beset, thrusting itself with tremendous force against her port side. For the first time the *Fram's* timbers creaked and groaned; it seemed almost incredible that human work should be able to withstand such stupendous forces as were set in motion. But the *Fram* held her own, broke loose from the ice, and rose slowly from her icy bed without a sign of damage in any part of her. I infer from this, and several similar experiences, that the Polar sea can be traversed with moderate safety in the manner we adopted, if only proper provision be made. One is exposed to dangers, of course, though they are not so great but that many other modes of travel entail perhaps quite as much risk; and, granted that this is so, then I think this manner of travelling offers such great advantages that it ought to be adopted in the future, seeing that a ship drifting like the *Fram* through unknown regions affords the best means of making scientific investigations of all kinds. It is only by a sojourn of years that sufficient material can be collected to enable a fully satisfactory picture of the physical conditions of these regions to be formed. In a vessel like the *Fram*, it would be possible to fit up on board laboratories in which even the most elaborate scientific investigations could be made. Should an expedition of this kind go north through the Bering Straits and enter the ice in a northerly, or perhaps north-easterly, direction, I think it would bring with it, when it eventually emerged into open water on this side of the Pole, a sum of information which would quite put the work of the *Fram* and her men in the shade.

But such a drift would take a longer time than ours did, and, many people might urge in objection, would expose its members to dangers, because a sojourn of years in these parts would be injurious to health. I cannot, however, agree in this. From my experience, I must say that I found the Arctic regions a very healthy place of resort, and as a proof of this I may mention that when I returned from wintering on Franz Josef Land I was stouter than I had ever been in my life before. On the trip from the *Fram* to Jackson's quarters I gained no less than twenty-two pounds in weight. Something of the same kind was also my experience when on board. As far as I could see, the rest of the party were perfectly well, and the physiological examinations which were made on

board seemed to point in the same direction. This material will throw light on the hygienic conditions during our expedition, and may be very important in view of future expeditions; but, unfortunately, it is not sufficiently worked out to allow me to set it forth here. I dare only say that the malady which has hitherto been feared more than anything else in Arctic exploration ought not to occur often, as it is undoubtedly very easily avoided if proper precautions be taken.

Dr. Torup, professor of physiology at the University of Christiania, has come to the conclusion, after examining the subject, that scurvy must arise from poisoning, caused, in particular, by badly preserved meat and fish. He thinks that in the decomposition which takes place in meat imperfectly cured—in salt meat, for instance—there is poisonous matter allied to the so-called ptomaines, which, when constantly partaken of, engenders the malady we call scurvy. Particular attention was paid to this at the time of our equipment, and from our experience and the investigations I had the opportunity of making during our journey, I can entirely subscribe to Torup's opinion on the matter. It is to be hoped that in the near future there will be scientific elucidation of this important point; and it is equally to be hoped that certain means for avoiding the hitherto so fateful sickness may be devised.

Another thing with regard to the mode of investigation of the Arctic regions which our expedition learned was, perhaps, this—that even with small means good results can be obtained. By acting on the hints given by the Eskimo, and pushing forward with kayaks, sledges, and dogs, one is enabled to penetrate into, and cover considerable distances in regions which have hitherto been considered very difficult of access. The drift-ice itself can thus be travelled over, even at a considerable distance from land—even where it is in motion; and I think this is one of the ways in which it should be endeavoured to investigate the great unknown region between the North American Arctic archipelago and the Pole. Here, no doubt, many interesting problems are awaiting their solution. May a not far distant future see those tracts trodden by human feet.

A VISIT TO MOUNT TARAWERA.

By Henry M. Cadell of Grange.

(*With Maps.*)

New Zealand has been called the "Britain of the South," and in so far as its area and insular position are concerned, the description is no doubt apt enough; but in physical geography, climate, scenery, and variety of natural resources, the Britain of the South quite surpasses its northern prototype. It may, I think, be safely asserted, that for its size New Zealand is the most interesting part of the British Empire, the only misfortune being its great distance from home, which prevents it from

receiving the attention at our hands to which its many natural advantages entitle it.

New Zealand has been richly endowed with the stores that go to build up the wealth of nations, and if the colony is not so prosperous as it should be, the fault must not be laid at Dame Nature's door. Its mountain slopes are at many places clad with forests of valuable timber, while beneath the surface there are rich mines and coal deposits that have as yet been scarcely touched. Most of the useful metals occur in greater or less abundance, and gold is to be found in formations of widely separated geological age, both in the North and South Islands, and in positions where it can be mined under conditions often more favourable than those which obtain in Australia or South Africa. Mountaineers in search of pastures new are beginning to leave the well-beaten tracks in Europe, and turn their eyes and feet towards its unscaled peaks and Alpine solitudes, with their valleys, lakes, and glaciers of surpassing beauty and magnificence. The climate of New Zealand, which varies between sub-tropical and temperate, has been so often praised that further reference to it is unnecessary here, and the whole possibilities held out in the way of colonisation and agriculture are almost unlimited. The natural flora of the islands is luxuriant; but it is a remarkable fact that New Zealand contains no fauna of any importance, so that one can roam through the silent, tangled forests of tree-fern, creeper, and pine, without any chance of treading on a snake or a scorpion, or of meeting any four-footed inhabitant more formidable than a rabbit or a wild hog of European pedigree.

It is to some of the features of its interesting physical geography that I wish now more particularly to refer; and here again New Zealand presents to us a fully plenished storehouse of materials in which the geologist and the physical geographer may well delight to revel. Iceland has its active volcanoes, snowfields, and geysers; but all are more or less inaccessible, owing to the unfavourable climatic conditions in that desolate island. In the Yellowstone National Park of America there are splendid geysers, hot springs, and the ruins of old volcanoes, but none which has been active within historic times. In New Zealand, however, spread out before us, are abundant examples of volcanic phenomena in all stages of development, as well as snowfields, glaciers, and evidences of the working of earthquakes, and other striking geological agencies. We can study in the North Island the old Tertiary andesite lavas and rhyolites of the Hauraki goldfield, in which the gold reefs are found, and the extinct cones and craters of the Auckland district of more recent age. From these evidences of ancient volcanic action it is natural to pass on to the thermal springs, geysers, mud volcanoes, and fumaroles of modern times, and these again lead us up to the vents of Tarawera, and the huge, steaming craters of Tongariro and Ruapeho, that rise majestically towards the clouds amidst their covering of perpetual snow. We find, therefore, in New Zealand a combination of the wonders of the Yellowstone and Iceland, in a country that has many additional points of interest, not too far apart, and fairly accessible from the sea on all sides.

In September 1895, while returning home from Australia, I took advantage of a favourable opportunity to visit the North Island, and spent some time in the Hot Lake district, within range of Mount Tarawera and the principal geyser basins. The terrible eruption of Mount Tarawera on the 10th of June 1886 will long be remembered in connection with the destruction of the famous Pink and White Terraces of Lake Rotomahana. Every traveller bent on seeing the "lions" of the North Island made a point of visiting the Terraces, and descriptions of their beauties have been published by many authors, the last of whom, Mr. Froude, gave in his *Oceana* a graphic account of his experiences in the Hot Lake district the year before the great catastrophe took place.

To those readers who may not be intimately acquainted with the geography of New Zealand a few words of explanation may be useful. To employ a very homely illustration, the North Island looks on the map like a shabby old boot with a high, narrow heel, and a long, ragged toe pointing to the north-west. The Bay of Plenty forms the well-marked instep, and the Hauraki Peninsula represents a part of the sole that has left the "uppers," and is hanging in shreds ready to drop off, the Firth of Thames being the gaping rent produced by the tearing open of the sole. Auckland is situated at the top of the toe, a short distance below the lacing, and the volcanic zone, which comprises the hot springs and active volcanoes, extends from the middle of the instep in a south-westerly direction through Lake Taupo. This extensive lake and the active or dormant volcanoes of Tongariro, Ngauruhoe, and Ruapeho (8878 ft.), to the south-west of New Zealand, form what may be compared to a large patch on the top of the ankle, while the magnificent snow-capped cone of Mount Egmont (8270 ft.) rises in solitary grandeur at the extreme south-west corner of the island, and marks a separate volcanic focus, the heat of which has apparently died out long ago.

The splendid harbour of Auckland, with its islands, bays, and green smiling shores, dotted with comfortable houses and blooming gardens, reminded me of the Kyles of Bute and the Mediterranean combined, and few panoramas in the southern hemisphere are said to approach in beauty the view from the old crater of Mount Eden, immediately behind the town. Auckland has been named the Naples of New Zealand, but its Vesuvius is no longer active, and although some sixty-three craters have been counted within a radius of ten miles, we must take the train and travel 134 miles south-eastward before the first symptoms of the dormant volcanic fires become perceptible.

Rotorua, a township on the flat shore of Lake Rotorua, forms the railway terminus, and as we approach it the smell of sulphur in the air, and the clouds of steam circling lazily upwards through the ti-tree bush, show that we have reached a place where the crust is dangerously thin, so that we can hardly consider ourselves standing on *terra firma* proper any longer. Lake Rotorua, a sheet of water about twenty miles in circumference and one thousand feet above sea-level, is, next to Taupo, the largest lake in the North Island. It lies in a roundish depression not more than about thirty feet deep, which may have been produced by a volcanic subsidence. Abundant signs of thermal activity appear along

From photograph by Mr. J. Martin, F.G.S., Auckland.

THE WHITE TERRACE CUPS.

its shores in the shape of hot springs, boiling mudholes, fumaroles, and sulphur baths, greatly valued by invalids. The surrounding country is uneven and hilly, and is covered by a dense growth of the ti-tree or manuka bush, which in winter has a warm russet brown hue like heather, but is spangled with white blossoms when the bloom is on. The principal geysers are grouped together at the native village of Whakarewerewa, two miles south of the township of Rotorua. These are exceedingly interesting, but are not nearly so fine or so imposing in their performances as the splendid geysers of the Yellowstone, which I visited in 1891. The art of soaping the geysers, which was accidentally discovered in the Yellowstone Park, is practised here when an eruption is wanted to order; and after trying the experiment by means of a bar of soap cut up into small pieces and thrown into the funnel, we were successful in inducing Pohuto, one of the principal spouters, to favour us with a very creditable performance. At the sanatorium of Rotorua, on the shore of the lake, some interesting experiments were made a few years ago by Mr. Camille Malfroy, C.E., the engineer in charge of the Government works there, after the eruption of Mount Tarawera.[1] These experiments were designed to illustrate Mr. Malfroy's theory of geyser action, and went to show that the difference between a fumarole, hot spring, mud volcano, and a true geyser is very small, and depends on the shape of the funnel and the facilities for the descent of water to the heated cavities below. The practical result led the author to conclude that geysers can be regulated and controlled to some extent, and hot springs can be converted into geysers by certain mechanical arrangements, and made to play at will. In proof of this, the hot springs supplying the baths at Rotorua were converted into small geysers at Mr. Malfroy's suggestion, and have continued to play regularly for the entertainment of visitors. It may appear sacrilegious thus to interfere with curious natural phenomena, and thrust iron pipes and concrete into the throats of beautiful boiling springs. To my mind, however, the charms of nature can in this way be greatly enhanced, and one can only regret that the geysers of Whakarewerewa have not been improved a little in their working. There is ample room for scientifically embellishing both their sinter deposits and their surroundings; but the Maoris, to whom they belong, do very little beyond drawing toll from visitors (which is done on correct and most scientific lines), and squatting in the warm pools with their wives and families. A feeble attempt has, it is true, been made to build up the sinter, so as to produce in time a far-off imitation of the lost Terraces, but much more might be effected in this direction, both at Whakarewerewa, Wairaki, and at other places, were the custody of the geyser basins in more intelligent hands. Soaping the geysers has been prohibited in the Yellowstone Park, and other regulations have very properly been strictly enforced for the preservation of their amenity; and perhaps at some future time the Government may see fit to acquire the New Zealand Wonderland in the same way, and improve it for the benefit of the public in all time to come.

[1] For an account of these experiments see Mr. C. Malfroy's paper, "On Geyser Action at Rotorua."—*Transactions of the N. Z. Institute*, 1891.

Mount Tarawera is about twenty miles by road from Whakarewerewa. The first ten miles are covered on horseback *viâ* the old road through the Tikitapu bush to the ruined village of Wairoa. Before the eruption, when the shores of Lake Tarawera were inhabited, and there was a well-populated township at Wairoa, the road was used for vehicles, but it is now merely a bridle track, the greater part of it having been destroyed or allowed to go to decay for want of use. For the first few miles the road runs along a flattish plain that slopes gently from the high ground towards the shore of Lake Rotorua, and is clad with a bosky mantle of ti-tree bushes. The ground is all made up of volcanic ash of various ages, most of it being light yellow or grey pumice, the product of ancient eruptions. The ash of Mount Tarawera is dark grey or nearly black, and it is thus an easy matter to tell when we are within the area affected by the eruption. At first the traces of the eruption are only apparent to the trained eye of the native of the district, but soon the layer of dark material becomes evident to the most careless observer. The limits of the ash have been carefully mapped out by Professor Thomas, of Auckland University College, who investigated the district immediately after the eruption, and published a valuable report on it in 1888. As the wind was from the south-west when the outburst took place, most of the ash was blown in a north-easterly direction towards the sea, and scarcely any fell so far west as Whakarewerewa and Rotorua. After leaving the plain the path turns southward through the once luxuriant Tikitapu bush, and follows for part of the way a small valley, on either side of which the hills rise to a considerable height. Moerangi, the highest summit, has an altitude of 2240 feet, and rises steeply from the shores of the Tikitapu and Rotokakahi lakes, whose waters once sparkled like sapphires in the sunlight, but are now as dull as milk, or at least as white as opals without the "fire." The fine bush along their margin is blasted and blackened, and although the luxuriance of the vegetable growth is, after ten years of repose, beginning to reassert itself, and clothe the landscape with some of its former verdure, many years must elapse before the first rude traces of the catastrophe become hidden from view.

One effect of the shower of ash on the physical geography of the district interested me exceedingly, and brought into prominence a phenomenon that can seldom be observed, from its rare occurrence. Where the fall of ash exceeded six inches, the whole ground was covered with a dense black skin, which, when saturated with rain, turned into an impervious bed of clay, that overspread hill and dale like a waterproof sheet. Before the eruption the rain fell upon ground thickly overgrown with vegetation, and a great part of the rainfall was thus retained for a time, absorbed, or allowed to trickle into the lakes or percolate slowly and quietly into the porous soil. After the coat of volcanic mud was put on all was changed. The heavy rains no longer fell on a bosky, absorbent surface, but were precipitated on to a smooth, watertight cover which, like the slated roof of a house, shed the drops as fast as they fell. The water ran in streams down the slopes, and these united to form fierce torrents in the flat bottoms of the valleys between the hills. These hollows had, in former days, been occupied by small rills that warbled

From photograph by Mr. J. Martin, F.G.S., Auckland.

ERUPTION OF THE WHITE TERRACE GEYSER, 22ND NOVEMBER 1885.

quietly down to the lakes without scooping out deep channels or notably wearing away their mossy sides. When these brooks gave place to roaring torrents that rushed along with wild fury whenever a heavy shower fell, and dried up as soon as the clouds rolled away, quite a new effect was produced on their beds. The waters quickly dug out deep channels, and in a short time their courses were marked by gorges or small cañons with perpendicular sides, which were undermined and further excavated by each fresh spate. The ground rock being soft, light pumice fragments, with little coherence, excavation was not a difficult matter.

As we approached Lake Tikitapu the road followed one of these stream courses, and we gradually ascended the valley for a few miles riding close to the edge of the cañon cut out during recent floods. Our Maori guide, A. Warbrick, said that the gorge in the middle of the valley had been nearly all excavated within the last five or six years, and had

THE CHASM ALONG THE ROAD TO WAIROA.

no existence before the eruption. It was at places over sixty feet deep, and the sides were perpendicular or even dangerously overhanging. At one place where the hillside above sloped rather steeply down to the chasm, the path, only about two feet wide, ran along the very brink. This was at a bend in the stream where its eroding power was greatest and the depth was fifty or sixty feet. I dismounted and led my horse past it, not relishing the idea of a possible fall over the edge on horseback. If the path were to give way under us it would probably be more comfortable to fall separately. After passing the critical place I looked round and found that the cañon wall was really overhanging, and I made up my mind that when we came back, another way past must be found out. When we did return in the evening there was no need of impressing this

caution on our guide, as the path had disappeared during our absence into the chasm! The above sketch, which was taken a short distance farther up the stream, illustrates roughly the appearance of this last product of the eruption. The walls of the gorge reveal an excellent section of the stratified pumice beds with which the old valley was filled, and at the time of our visit the weather was fortunately dry, so that the bottom of the stream channel was quite bare.

This particular cañon was, it must be stated, partly produced at first by a large earthquake crack, along which there were several subsidences, reaching at one place a depth of ninety feet, such as are common elsewhere in the district. The water took advantage of this line of weakness and has gone on excavating and widening it every year. The steepness of the walls shows that the process of excavation is rapid, and that the natural disintegration by the atmosphere and rain is quite insignificant compared to the erosion by the stream, just as it is on an infinitely greater scale in the celebrated Grand Cañon of the Colorado. The old valley, on the other hand, is shaped like a roofing tile, showing that the tendency to crumble away at the sides was formerly greater than the tendency to undergo deepening through the stream's action. An excavation of this sort starts at first by the stream eating down its bed near the lower end, where it debouches on flat ground and has a "free toom" or available space to deposit its burden of detritus in the shape of a fan or delta. The gorge begins at the apex of the cone, and when once started eats its way steadily backwards up the valley, deepening and widening its section as it grows in length; and so long as the fall is great enough to let the stream carry away all the detritus, the process will go on. As we proceeded on our way this was made quite clear, for the chasm grew smaller and narrower, so that at last we could step across it, and it finally dwindled down to a mere fissure a yard or two deep, on the line of the old earthquake crack, with vertical walls entirely bridged over at places by the vegetation.

This is only one, and perhaps not the best, example of a process that is going on all over the ash-covered district. Professor Thomas told me of other and much deeper gorges produced in the same way, without the assistance of earthquakes. Now it is interesting to note that this is only a temporary phase of the physical evolution of the region. Provided no fresh eruptions occur, the ashy covering will be gradually washed off the hills, or at least the deposit will disappear under the growing vegetation, so that the sudden torrents will diminish in force and erosive power. The sides of the gorges will fall in, as it is not natural for soft strata to stand long in the form of vertical cliffs where the climate is moist and the rainfall abundant. Small but regularly flowing streams will again occupy the channel, and these will not be able to transport all the stuff that falls into them, so that in time there will be found a smaller tile-shaped valley inside the greater, and a step-like feature along the hillsides will be all that remains of the original perpendicular cañon walls shown on the sketch.

In the Taupo volcanic district the tributaries on the right bank of the Waikato river, which is far beyond the area of the Tarawera ash,

WAIROA TOWNSHIP BEFORE THE ERUPTION.
LAKE TARAWERA IN DISTANCE.

SITE OF WAIROA AFTER THE ERUPTION.

have cut cañons with vertical sides 200 feet or more in height. Professor Thomas points out that the preservation of the walls is largely due to the porous nature of the pumice strata, which allows the rain to sink into the ground instead of streaming over the surface and wearing away the margin of the cañon. The preservation of the walls of the Grand Cañon of the Colorado is due, on the other hand, to the very small rainfall of the part of America across which the greater part of the river has formed its bed. The absence of frost is also conducive to the preservation of sharp natural features of this sort, since soft, porous cliffs would, in a wet region nearer the Poles, be particularly liable to disintegration by the winter's frosts.

The township of Wairoa was, up till June 1886, a smiling village, beautifully situated in a valley, amid luxuriant forests and well-tilled land, on the banks of the stream that falls from Lake Rotokakahi into Lake Tarawera. It is now a blasted and blackened waste, with ruins of wooden houses half buried under ashes; and the solitary inhabitant that met us was a brown cat, the only resident that had, after escaping with a whole skin, apparently thought the place still attractive enough for a permanent residence. The trees were partly burnt and partly overthrown by the fury of the indraught of wind caused by the eruption; but these are now sprouting again, and the dull, leaden grey of the landscape is becoming enlivened with spots and patches of warm russet brown or green. Professor Thomas has calculated that Wairoa is situated at the outer edge of the area over which the ash fell on the average three feet deep, and as we approach the volcano the depth of course continually increases. A fall of from two to three feet of ashes and mud may not seem a very serious matter, but it was quite enough to crush in the frail roofs of the houses and cause the death of over a dozen persons. The eruption took place suddenly in the small hours of the morning, and in the pitchy darkness it was impossible to escape. The two native villages of Te Ariki and Moura, on the shores of Lake Tarawera, near the volcano, were entirely overwhelmed, and not a soul was left to tell the awful tale of their destruction. Altogether 111 natives and Europeans were killed, the majority of the inhabitants of Wairoa having survived the eruption, which, though terrific while it lasted, did not happily last long, but was all over, so far at least as the ash shower was concerned, in about five hours. Although large volumes of steam continued to rise from the newly formed vents for months afterwards, no fresh explosion has since taken place, and the mountain has been steadily cooling down for the last ten years, almost no steam being now emitted from the craters.

We left our horses at Wairoa, and clambered down the steep path past the charming waterfall at the head of an arm of Lake Tarawera to the white beach of pumice and obsidian sand, where our Maori guides had a boat ready to take us to the volcano on the opposite shore. As we rowed across the milky waters our boatmen related how, eleven days before the eruption, the inhabitants of the native settlements on the shores had been startled by the form of a huge, phantom war-canoe moving stealthily over the lake, coming from an unknown port, and going no one

knew whither. The meaning of this apparition was not understood at the time; but after the catastrophe was past, the few survivors were convinced that this had been an omen from the world of spirits to warn them of the approach of the destroying angel.

The length of our little voyage was about eight miles, and we landed in a bay where a torrent had cut out a gorge in the black scoriæ and spread out the detritus in the form of a broad fan sloping gently downwards to the beach. The configuration of the ground has here been entirely changed by the eruption. For miles around, the shores of the lake, once decked with luxuriant vegetation, are now deeply buried under a leaden grey coating of volcanic mud and scoriæ. The surface of the ground is cut up with multitudes of deep, wavy furrows, as if it had been raked all over with gigantic combs. At places these furrows are so deep and numerous that they resemble glacier crevasses, and make the country quite impassable for man or beast. They can be seen miles away from the neighbouring hills radiating outwards and sweeping in regular curves corresponding with the changes in the slope of the ground. A good impression of the remarkable appearance of the district may be gained by looking at the hill-shading on some of our Ordnance maps, whose black radial hatchings bring to mind the black, sharp groovings in the scoriæ hills round Mount Tarawera.

Mount Tarawera is an ugly, flat-topped mass that rises steeply from the lake, and at the water's edge terminates in abrupt cliffs. The lake is about 1000 feet above sea-level, and the mountain rises over 2700 feet higher, so that the climb is not a matter involving much expenditure either of time or muscle. The upper part of the mountain is entirely made up of black or reddish scoriae, lapilli, and dark rounded bombs or "fireballs" of augite-andesite lava with a vesicular spongy core and a hard shell rather smooth at times on the surface. In many cases, however, the core is seen to be a lump of white, hard rhyolite, the rock of the original Mount Tarawera. This has been blown into fragments, many of which were wrapped round with a skin of the black andesite lava during the progress of the eruption.

On reaching the crest of the ridge a strange scene presented itself. After climbing the steep, ashy slope we came suddenly to the brink of the great chasm that has cleft the mountain into two parts. This huge fissure extends for a distance of over nine miles through the top of Tarawera and the site of Lake Rotomahana at its base, on whose shores the Terraces were situated. The eruption produced a row of deep craters along this line, and these are separated by a series of bridges or partitions, some of which are quite sharp and thin at the top, and others have a breadth of several hundred yards.[1] The sides of the chasm reveal an interesting section of the mountain, which is seen to be made up of cream-coloured rhyolite lava beneath, with deep red or dark grey stratified ash-beds at the top, and here and there a dark, slaggy patch of the new lava plastered on to the side, or lying like a saddle on the back of the

[1] These diaphragms or bridges are shown on the accompanying map of the great fissure and lake.

separating bridges. With the exception of these isolated splashes, there is no sign of any lava streams among the products of the eruption. The eruption produced nothing but ashes and scoriæ, and this is to be explained by the fact that there was so much water present that the molten rock beneath was blown to fragments by the sudden expansion of the steam imprisoned in its pores before ever it rose to the edge of the craters. There was, no doubt, lava at a certain depth, and some of it can be seen in the bottom of the deeper craters, and the fact of its existence proves that a true volcanic eruption took place, and that the explosion was not due merely to the pressure of highly heated steam. Small volcanoes are sometimes produced by steam explosions, but in such cases the materials thrown out are found to be composed of shattered fragments of the rock beneath, unaccompanied by matter of a genuine eruptive character. The sides of the chasm are still warm at places, and hot vapour or steam issues from cracks along the edges here and there.

The eruption of Tarawera did not last long—only about five or six hours—but while it lasted the explosion was one of tremendous energy. A long row of huge craters, some of them over 800 feet in depth, were blown out of the solid rock, and from these was ejected a shower of stones, mud, and ashes, estimated by Professor Thomas to have a bulk of 1,960,000,000 cubic yards, or nearly two-fifths of a cubic mile. The ash fell over an area of more than 6000 square miles on land, and a good deal was carried away seawards by the south-west wind, to fall into the Bay of Plenty.

The observations of Mr. Percy Smith, Assistant Surveyor-General, who has from time to time published very accurate maps and reports on the volcano and its surroundings, show that the effect of the accumulation of ash was to raise the summit of Tarawera to 3770 feet, which is 164 feet above its original altitude.

The most important change in the topography of the district is the formation of the new Lake Rotomahana at the western base of the mountain, and about half a mile south from the nearest part of Lake Tarawera. The general appearance of the new lake is shown on the accompanying topographic sketch, and on the right a small part of the Tarawera lake comes within the view. The crater lake of Rotomahana has steep sides, and covers the hollow in which were situated the small Lake Rotomakariri, and the larger hot lake Rotomahana, whose shores were adorned by the terrace formations. The surplus waters overflowed into Lake Tarawera by a small stream which has been obliterated by the eruption. During the explosion the lake was entirely blown up, and a huge hole formed with a small pool in the bottom about 400 feet below its original surface. The line of the great fissure ran straight through the top of Mount Tarawera and the bed of Lake Rotomahana, and a row of craters mark its course across the country. Another crater lake farther along the line of the chasm, and close to the foot of the mountain, was produced at the same time, and was named Rotomakariri, after the original tarn of that name. Both lakes have gradually been filling up, and now, instead of together occupying an area of about twenty-five acres, which they did in August 1886, they have

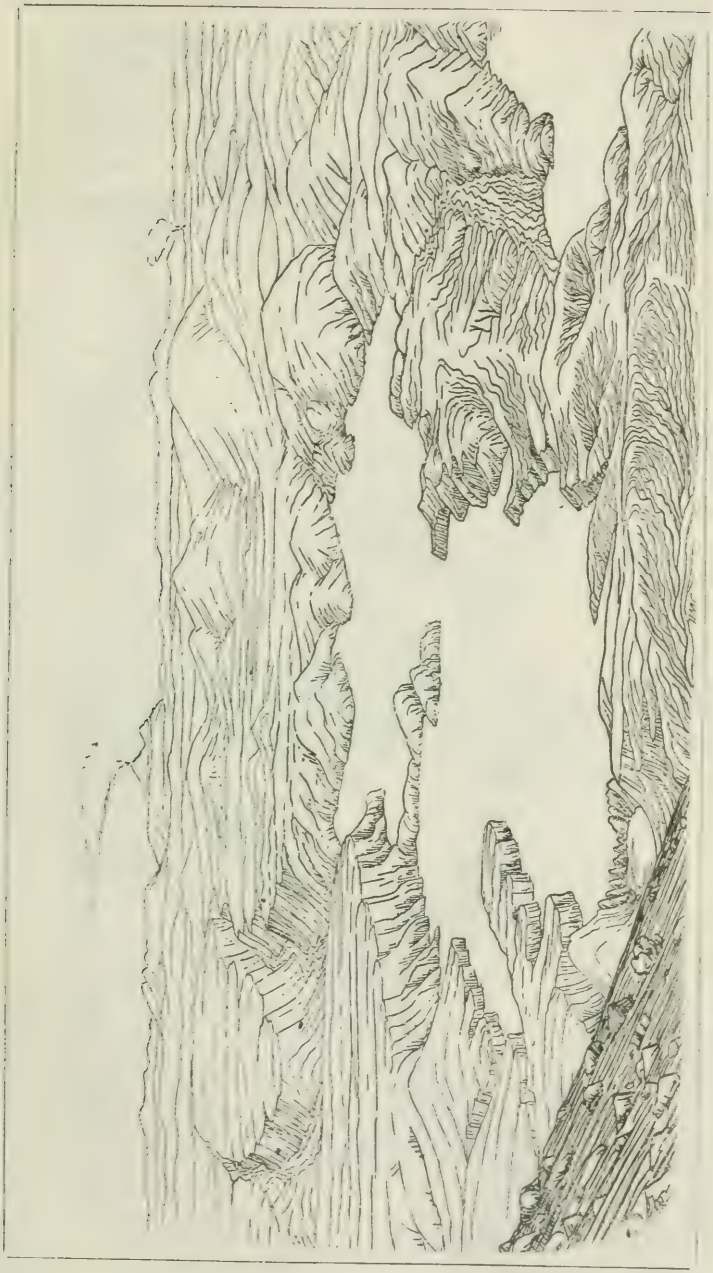
joined into one imposing sheet of water, three miles in length, covering 5600 acres or more. The level of the water was found, from surveys made in 1893, to have risen 420 feet during eight years, and at the time of my visit in 1895 it had crept up still farther, and covered up some of the features shown on Mr. Percy Smith's map published in 1894. When it rises to 1080 feet above sea-level, or ninety-five feet above its level in 1893, it will either find a subterranean outlet through the porous soil, or it will overflow the ashy ridge, and again find an outlet to Lake Tarawera. A channel in the soft scoriæ will again be excavated, by which a considerable part of the water will be drawn off, and the surface of the lake will, after reaching a maximum, begin to decrease in area, leaving no doubt a small notch or terrace round its margin to show the line of high-water mark. The accompanying map shows the great fissure, the original lakes Rotomahana and Rotomakariri, and the area of the new lake at the date of my visit.

The accompanying topographic sketch from near the top of Tarawera shows the appearance of Lake Rotomahana and the country to the west and south on the 27th September 1895. The day was happily very clear, and we were fortunate in catching a glimpse of the top of Ngauruhoe and Tongariro, about ninety miles off on the south-western horizon; and as the clouds lifted for a few minutes, the steam issuing from the cone of Nganruhoe (7841 feet) was distinctly visible.

A sharp pointed rock, known as the Pinnacle, formed a prominent landmark on the north or right side of the Rotomahana crater after the eruption. As the water rose, the Pinnacle became an island, and gradually diminished in size until nothing but the tip appeared above water. This was shown on Mr. Percy Smith's panorama, taken in 1893, and published along with his latest report in the following year, and at the time of my visit the continued rise of the lake was clearly proved by the diminished size of the Pinnacle, which is shown on the sketch as a mere speck, and may by this time have completely disappeared. The Pinnacle was close to the White Terrace and near the head of the Kaiwaka stream, by which the old Lake Rotomahana overflowed into Lake Tarawera. The course of this stream is still marked approximately by the storm channel shown on the sketch.

The view north-eastwards along the volcanic belt was equally clear. The following sketch gives a glimpse of the Tarawera chasm and the craters and bridges between them, and on the horizon on the left is seen, far out to sea in the Bay of Plenty, the great fumarole of White Island, seventy miles distant, from the summit of which clouds of steam are constantly rising. The panorama from Mount Tarawera thus embraced a distance of 160 miles, and included the entire length of the volcanic zone, between whose extremes nearly all the curiosities of the New Zealand Wonderland are to be seen.

Mount Tarawera gives an example of what has taken place in prehistoric times, and what may again take place within this thin-skinned region. The presence of so much water—an important factor in volcanic eruptions—with the evidence of great heat not far down, make it quite likely that the district may at any time be visited by a similar catastrophe



VIEW SOUTH-WESTWARD FROM MOUNT TARAWERA SHOWING THE NEW LAKE ROTOMAHANA.

VIEW LOOKING NORTH-EASTWARD FROM THE EDGE OF THE CRATER OF MOUNT TARAWERA.

to that of the 10th of June 1886. Happily that part of New Zealand is mostly poor in soil, and but thinly inhabited, and after what has already happened, sensible people should not settle too near the volcanic zone, but keep away from such an uncanny corner of the Empire. It is a place well worthy of an occasional visit, and its sulphur baths are almost unsurpassed in medicinal virtue; but beyond this, the district should be regarded as a great natural museum, full of rare and awesome objects, highly instructive indeed, and well deserving of a visit, but not adapted for purposes of settlement or permanent residence by a large population.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lectures held in April.

Professor Prothero delivered, by special request, in Edinburgh, on April 8th, an address on the "Principles of Federation," as a sequel to the series on the "Unity of the Empire," reported in previous numbers. Sheriff W. C. Smith presided.

"The Market Fishes and Marine Commercial Products of Australia" was the subject of a lecture delivered by Mr. W. Saville-Kent, in the Society's Hall, on April 22nd. The Chair was taken by Mr. Grant Ogilvie.

Meetings in May.

On May 7th Sir Henry Tyler will address the Society in Edinburgh, at 4.30 p.m., on "The Geography of Routes of Communication."

It is hoped that a lecture on Queensland may be arranged in the latter part of the month.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Rain, Evaporation, and Drainage in Bohemia.—The concluding number of the fifth volume of Professor Penck's *Geographische Abhandlungen* contains the results of Dr. Vasa Ruvarac's measurements of rainfall and river discharge in Bohemia, and an essay by Professor Penck on the relations of rain, drainage, etc. We can select only a few facts from the concluding chapter of this work.

During the five years 1876-90 the mean annual volume of rain that fell in Bohemia was 8·45 cubic miles, corresponding to a mean fall of 27·24 inches. This mean height was exceeded over 42·4 per cent. of the country, and not attained over 57·6 per cent. The rainfall is heavier in the higher parts on the borders of Bohemia—the crests of the Böhmerwald, the Riesen, Iser, and Erzgebirge, where the annual amount exceeds 47 inches—while in the central lower parts it is not more than 16 inches. In both parts there are localities evidently sheltered from the rain, while others are more especially exposed to it. The striking symmetry in

the configuration of the country is not reproduced in the distribution of rain; the western half is protected by the mountains that enclose the Elbe basin, while the eastern is exposed to the moist western winds.

A large part of the rain, namely, 6·1 cubic miles, corresponding to a fall of nearly 20 inches, is evaporated. To effect this as much heat is required as would melt a sheet of ice 12¼ feet thick, or eighteen per cent. of the total heat that reaches the ground when the sky is clear. The variations in the quantity of water evaporated are in a much less degree dependent on the temperature than on the rainfall. The more the rain, the greater the evaporation. The latter is, indeed, a function of the quantity, density, and distribution of the rainfall. There is an amount of rain which would only just compensate for the loss by evaporation, and this, from the variations observed, is calculated to be 14½ to 15¾ inches in the Moldau basin, and 10¼ in the remainder of the Elbe drainage area. Now, Professor Penck finds that the river discharge is proportional to the excess of the rainfall above this quantity. The influence of temperature on evaporation is much less. A rise of 1° C. causes an increase of only 19 mm. (¾ inch) in the evaporation.

The drainage is subject to variations comparatively much greater than those of rainfall and evaporation. On an average 2·35 cubic miles, it rose to 3·27 in 1890, while three years before it was only 1·52. Measured in depth over the surface of Bohemia the mean discharge is 7·56 inches; for the Moldau basin alone it is rather less—6·97,—and for the remainder of the country 8·23. Between the *increase* of rainfall and that of the river discharge there is a constant relation, that is, for the same region. (This must be distinguished from the ratio of rain to discharge, which is variable.) Consequently the rain chart is also a drainage chart.

These considerations are based on the supposition that the evaporation and drainage are together equivalent to the rainfall, and for long periods this is true. For short periods, however, the effects of storage must be allowed for. Five quantities, then, must be obtained in order to determine the discharge (a), namely (1) the rainfall (n); (2) the height of the rainfall, when there is no river discharge (n_o); (3) the ratio between the increase of precipitation and of evaporation (γ); (4) the variation of the temperature from the mean (t), and the ratio of temperature to discharge (α); (5) the quantity of water obtained from the storage of the previous year (s'), and the quantity stored in the year under consideration (s''). With these quantities the discharge is given by the following formula:—

$$a = (n - n_o)\,\gamma - t\alpha + s' - s''.$$

The Föhn of the Alps.—Last October a Föhn storm of unusual violence rushed down from the crests of the Swiss Alps, and was experienced not only in the northern plains of Switzerland, but even in the adjoining countries of Alsace and Baden. Great destruction was caused by it to buildings and forests in the Grindelwald valley, the Kander valley, and other places. To the high temperature this wind brings with it the Alpine furrows through which it blows owe striking climatic advantages. The almonds and figs of Weggis, the vineyards and oleander gardens of Vitznau flourish under its influence, though not far from eternal snow and extensive glaciers. The Föhn, descending the valley of the Reuss in autumn, winter, and spring, retards the advance of the winter cold, mitigates the severity of that season, and accelerates the advent of spring. The mean temperature is considerably increased at stations exposed to the Föhn, the annual mean for Gersau on the lake of Lucerne being 50° F., the highest at any cis-Alpine station except Montreux. This wind is also experienced in the Rhone valley, in the Linth valley, and in the Rhine valley down to the lake of Constance, while it attains its greatest development in the Ill valley in Vorarlberg.

When the Föhn is blowing the temperature sometimes rises as much as 30° above the normal, and as it is independent of the position of the sun, being as marked in the night as in the day, it can remove as much snow in twenty-four hours as the sun in a fortnight. A few years ago, in Grindelwald, it cleared away a covering of snow thirty inches deep in twelve hours. Without it the ground would be covered with snow all the year round, or at the most left bare too short a time for vegetation to come to perfection. Being exceedingly dry, the Föhn causes a large amount of evaporation, and thus prevents the floods of spring from rising as high as they otherwise would. On animals the effect is not so favourable; they become restless and wild, while human beings suffer from lassitude, and nervous temperaments are rendered irritable or despondent.

Until quite recently the Sahara has been looked upon as the origin of this wind, simply because of the heat that accompanies it. But the Sahara being in the northern hemisphere is hot in our summer, whereas the Föhn blows in the colder half of the year. Again, on the southern side of the Alps, there is calm weather when the Föhn is blowing on the northern side. Nor can it pass over Italy at a great height, for not the slightest trace of it has been noticed on the highest crests of the mountains. According to the latest theory, then, the Föhn is of local origin, starting from the crests of the Alps, and becoming gradually heated by friction and pressure as it descends into the valleys. It is called into existence by the low pressure systems which pass eastwards from the Atlantic across the northern side of the Continent. Towards these the air over France and Central Europe is drawn, and is sucked out of the northern valleys of the Alps. As a cyclone moves eastwards, the wind must of course change its direction, and the Föhn is usually succeeded by westerly winds laden with moisture from the sea. The barrier of the Alps is too high to allow the northern cyclones to influence Italy, but when a low pressure area is formed to the south or south-east, a warm dry wind called the North Föhn occurs in Tessin and is felt as far south as Milan.—*Deutsche Rundschau*, Jahrg. xix. Heft 6.

ASIA.

The Geology of the Caucasus.—In view of the excursion to the Caucasus that will be organised after the International Geological Congress, to be held this year at St. Petersburg, M. V. Dingelstedt has contributed to the *Nauchnoie Obozrenie* a sketch of the geology of the country, compiled from the latest authorities. Like the greater number of mountain chains on the Earth's surface, the Caucasus has been produced by folding of the crust. When the chain first came into being, and by what successive stages it has been upheaved, it is impossible to decide with any approach to certainty. But it may be said that the last upheaval from the bed of the sea took place in the second half of the Tertiary period. During the earlier part of this period, a nummulitic sea extended from Europe to Asia over the Armenian plateau, sending some deep bays into the Caucasus about the central part of the chain, between the basin of the Rion and the Jura valley. But the Meskhi range, with its raised deposits of the Cretaceous sea (Cenomanian and Gault), was already above sea-level, and nummulite beds have never been found on its flanks, whereas Daghestan was covered with the deposits of this Eocene sea. Later on, the southern plains of the Caucasus were elevated, and they apparently remained above the Sarmatian sea, which washed both sides of the Caucasus and had the Armenian plateau for its southern shore. The deposits of the Sarmatian sea were, in their turn, raised to a considerable height. Parts of Trancaucasia, elevated during this period, were again sunk below the waters in

Miocene times. In the Quaternary period there was a violent outbreak of volcanic energy, probably before the Glacial Age, but it had no marked effect on the formation of the mountains, or on the elevation of the land relatively to the sea.

The folds of the strata are much more sharply curved on the southern than on the northern side of the Caucasus, showing that the lateral pressure was much greater on this side, if, indeed, it were not absolutely confined to it. Here every form of fold may be observed.

The oldest formation in the country is undoubtedly the clay-slates lying immediately on the granitic core of the main range. Tilted almost vertically and strongly folded on the southern slope of the central range, they extend for a distance of 165 miles, and appear also on the northern flank—east of Adai-Kokh, for instance—forming the summits of several mountains, as the Sikari, Sita-Kokh, and Bruttsbzeli. Similar slates, as well as dark argillaceous limestones of the same age, cover also the greater part of the Daghestan mountains. Naturally, the determination of the formation they belong to is of great importance, as it would throw some light on the question of the first upheaval of the Caucasus range. Unfortunately, the only organism in this formation that has been identified is a seaweed, *Bythotrephis flexuosa*, common in Silurian beds. From this Ernest Favre assigned these rocks to the Palæozoic age, but other opinions have been expressed, Dubois de Montpereux referring them to the Lias, Murchison to the Oxfordian beds, and Abich to the Lower Oolite.

While there is so much uncertainty about the oldest sedimentary strata of the main range, there is none whatever about the age of the Minor Caucasus, of which the dark-grey, compact, fine-grained limestones have been classed by Abich in the Upper Devonian and Lower Carboniferous series. The formation extends north-eastwards, from the south of Ararat, in a broad belt across the plain of the Araxes to the Minor Caucasus, attaining a considerable height in the western half of Daralagoz, and buries itself under Cretaceous and nummulitic deposits. Abich collected from these beds many characteristic brachiopods.

What, then, has become of the Palæozoic rocks which were laid down in the ancient sea that undoubtedly covered the site of the present Caucasus? M. Dingelstedt believes that the explanation that has been given of their disappearance in the Alps may be applied to the Caucasus also. They have been, perhaps, partly washed away, while the remaining strata have, through the shrinking of the Earth's crust and the great pressure and heat thereby developed, been metamorphosed into crystalline rocks, all traces of the original stratification having been obliterated, and all organic remains destroyed. Granite, granulite, syenite, etc., in the Alps and Caucasus, and in other lofty mountain masses, may be merely metamorphosed sedimentary rocks.

The next series to be considered is the Jurassic, for the Triassic has not yet been found in the Caucasus. Not yet; but it was long before it was discovered in the Alps, though now four groups are recognised, and closer investigation may detect it in the Caucasus. The investigation of the Jurassic formation in the Caucasus has not proceeded so far that each group of beds may be distinguished by its characteristic fossil, as in Europe. The official geologists, A. Sorokin and S. Simonovich, have, however, divided the Oxford Oolites into two groups, naming the first after the brachiopod *Rhynchonella lacunosa*, Quenst., and the other from the ammonite *Phylloceras tatricum*, Pusch., neither of which organisms occurs among the distinguishing fossils of European groups, while the latter is not even contained in the collection of Abich.

The best account of the Jurassic fossils is to be found in *Ueber die von H. Abich in Kaukasus gesammelten Jurafossilien*, von M. Neumayr und V. Uhlig,

published in the *Memoirs* of the Vienna Academy of Science in 1892. Abich collected fossils at forty-eight places, most of them in the middle and eastern parts of the Central Caucasus, while the others were nearly equally distributed between the western part of the Central Caucasus, South-Eastern Caucasus, the southern part of the main range, and Daghestan, a small quantity only being obtained from the North-Western Caucasus. The whole collection contains representatives of 61 genera and 188 species. Crinoids and sea-urchins account for three genera, while all the other fossils are molluscs, cephalopods largely predominating. Of the age of the limestones of the Jurassic system in North-Western Caucasus Herr Uhlig was unable to form any conclusion, the fossils being too few. The northern slope of the Central Caucasus, on the other hand, furnished a very rich collection, by which the different beds could be clearly identified. In Daghestan, fossils were obtained from six localities, and in the South-Eastern Caucasus from Shakh-dagh and Shalbuss-dagh. But the most interesting Jurassic fauna was found on the southern slope of the main range, where also the officials of the geological survey have prosecuted their researches, but with less successs than Dr. Abich. The places Dr. Abich mentions as yielding fossils are Dzirula, Kadkhi, Kabag-tapa, Shamluk, and Korta. M. Dingelstedt gives a list of Dr. Abich's collection, full details of the localities where they were found, and also of the various groups of beds, with their peculiar fossils, so far, that is, as they can be distinguished at present.

The Cretaceous system is widely distributed both on the northern and southern slopes of the Caucasus. In the north the deposition of the strata of this period proceeded quietly, but in the south and in the heart of the Minor Caucasus it was frequently interrupted by volcanic outbursts, when various half vitreous, half crystalline, rocks were ejected, which may perhaps be classed as diorites. Caucasian geologists claim to have found in the country all the eight divisions of the French geologists except the Danian, though Favre mentions only six in the Northern Caucasus and Daghestan, and four on the southern slope. Of the fossils recorded from the Upper Neocomian series M. Dingelstedt remarks that very few are distinctively characteristic, while some have a very wide range. He also reserves judgment on the new forms said to have been discovered, until they have been more minutely described. With regard to the fossils from the Lower Neocomian there are also doubtful points. At any rate the geologists of the survey confidently assign the limestones forming the ridges of Nakerala and Tashava, those lying on the northern slope of Aamli, on both sides of the rivers Rion and Krasnaia, and elsewhere, to the Upper Neocomian, while the Lower Neocomian is found in many places in the Kutais government—Imeritia, Svanetia, etc.

While in Europe the land during the Eocene period was rapidly gaining in extent, the Caucasus was covered by the Mediterranean sea, in which abounded low microscopic organisms—*Foraminifera* and especially nummulites. The nummulitic formation of the Eocene and Oligocene periods is found in abundance on the southern side of the Caucasus, to the south of the Kura and Rion valleys in the Akhaltsykh mountains and the Minor Caucasus, but is apparently absent from the northern slope, for neither Abich nor Favre observed it there. To the Eocene system Dr. Abich refers the marls, shales, and sandstones resting on the Cretaceous rocks along a great part of the northern slope of the main range, and particularly in Daghestan between Sulak and Temirkhanshura and to the south of Petrovsk.

Oligocene deposits are very poorly developed in the Caucasus, or have been little investigated by geologists. In 1883 MM. Sorokin and Simonovich discussed in the publications of the survey the question whether they existed at all in the

Kutais government, the best-known part of the country from a geological point of view; and, though they decided in the affirmative, their conclusion was not based on palæontological facts, but on similarity of position and the petrographical character of the rocks. The formation has been most thoroughly explored in the Akhaltsykh basin, and some scanty collections of fossils have been made. MM. Sorokin and Simonovich distinguish three groups of beds, which they name simply Lower, Middle, and Upper Oligocene, without indicating their relationship to the generally recognised divisions. This classification seems to be scarcely justified by the few fossils collected, many characteristic forms being absent, while *Buccinum postulatum* belongs to the Pliocene period: four forms, however, are characteristic of the Hempstead beds.

Of later Cainozoic systems only Sarmatian beds exist in the Caucasus. The Sarmatian sea probably covered the greater part of the Kuban government and the Stavropol district, encircled the main chain, and extended westward to Vienna and eastward to the basin of the Amu Daria, while on the south it was bounded by the Armenian plateau, and on the north probably joined the northern sea. The Sarmatian beds have been investigated principally in Kartalinia, where M. Sorokin has distinguished six groups with a total thickness of nearly 2300 feet.

This short note can give but a very inadequate notion of the contents of M. Dingelstedt's article. The lists of fossils from each system are given and their bearings discussed, and the full information on the divisions adopted by Caucasian geologists and their European equivalents will be very useful to foreign visitors.

AFRICA.

From the Mobangi to Lake Tsad.—M. Maistre on his journey from the Mobangi to the Shari followed the valley of the Kemo (vol. ix. p. 316). M. Gentil, who has been sent up to the Shari with a small steamer portable in sections, has found that the Tomi, an affluent of the Kemo, which was partially explored by M. Maistre (vol ix. p. 425), affords a better route to the north, being navigable all the year round up to a village called Krebeje, 5° 46′ N. lat. From here M. Gentil and his colleague, M. Huntzbuchler, crossed the watershed, and in September last reached the river Nana, where he established a post in lat. 6° 46′ N. The latter river, where the expedition struck it, was more than fifty yards broad and navigable. Having put his steamer together, M. Gentil descended the river for a distance of 10′ northwards, where it joins the Gugu. Thirty miles farther this river enters the Gribinghi of Maistre, which he supposed to be the Shari, but is probably only one of its chief affluents. Perhaps before this time M. Gentil's steamer, the *Léon Blot*, has entered Lake Tsad.

Dr. Max Esser in South-West Africa.—This traveller who, as already announced, has discovered a bay on the coast of the German territory, which may possibly be utilised as a harbour, set out on his expedition from the Portuguese port of Mossamedes, and after two days' march reached Port Alexander, an excellent harbour formed by a large, rocky promontory. Unfortunately good drinking-water is not to be had here; but nevertheless the catching and drying of fish, an important article of food among the black labourers of the West African coast, is a thriving industry. The population of Port Alexander numbers about 700, and consists of Portuguese fishermen from the province of Algarve and natives captured in battle, who are sold at the slave-markets of Benguella for £20 to £25 apiece.

From Port Alexander the party followed the dry bed of the Coroca, about one and a quarter miles broad and exceedingly fertile. Large sugar-cane plantations are laid

out there, and in the dry months are irrigated by the pumps of the distilleries. On leaving the Coroca, Dr. Esser marched eastward over grassland to the country of the Makua Matafe, cave-dwellers, who keep large numbers of goats. The game is here exceedingly plentiful—buffaloes, giraffes, gnus, and elephants. On the southern edge of the Chella mountains wander the Muquichs, a brave and intelligent people. For slaves they have men of the Ba Cubabe race, the dirtiest and most degraded of Africans. They cultivate no crops, but live on raw roots and leaves, and differ little from the brutes. No fire was seen in their villages. On the eastern side of the Chella live Waherero, a people found also in Damaraland.

An English expedition was said to have discovered rich deposits of gold at Cassinga, to the north-east of Humbe. That the land is auriferous Dr. Esser had many proofs, for he found Boers washing successfully. They employed black slaves, whom they kept hard at work by skilful use of whips of giraffe leather sixty-five feet long. The Portuguese Government does not care to throw open the goldfields, lest the stream of immigrants should overwhelm the few Portuguese settlers.

Near the cataract of Quenguari both banks of the Cunene are thickly peopled. The country is intersected by a large number of dry watercourses, which in the rainy season carry more than thirty feet of water. Between the streams grow palms of a kind Dr. Esser had seen nowhere else in Africa. They are very tall, and on their stems grow bunches of marone-coloured fruits about the size of a mandarin, and of a sweet, agreeable flavour. The Cunene has made itself a passage two to two and a half miles broad through huge granite rocks. Above the cataract the water is very shallow —nowhere as much as three feet deep. In some parts the current is very violent, where the stream suddenly contracts and forces its way through a rocky portal only sixteen to twenty feet broad. Below the falls of the Black mountain the river runs with a quieter current in a bed eighty or ninety yards broad, and forms, as elsewhere, islands. On many of these antelopes are numerous. From the Sta. Maria river, where the Tertiary region begins, the Cunene is probably navigable nearly to its mouth. On the left bank runs a range of white sandhills, 650 feet high, in a direction south-south-west, forming the southern and eastern boundary of a plateau sloping to the sea with a declivity of about $1\frac{1}{4}°$. Along their foot runs a deep river bed. Probably at one time the Cunene, which now follows the northern edge of this plateau, washed the foot of the hills, or, at any rate, was divided into two arms. The sandhills terminate in a promontory running into the sea and forming the bay already referred to. Dr. Esser believes that boats could enter the bay from the north when the weather is calm. The mouth of the Cunene is quite unapproachable, being silted up, and the ground being covered with quicksands.

The party left the Cunene at six o'clock in the morning, and, to their surprise, reached Tiger Bay at five o'clock the same day, whereas they expected from an inspection of the maps that the march would be of two or three days' duration. The route crossed a plateau of rock excellent for travelling over, and never rose to a height of more than 300 feet. Tiger Bay, twenty-six miles deep and fourteen broad, is the finest and best harbour on the West African coast.—*Verh. der Gesell. für Erdkunde zu Berlin*, No. 2, 1897.

AMERICA.

Crater Lake, Oregon.—While there are many lakes of different kinds in the United States, there is but one crater lake, which is fully described by Mr. J. S. Diller of the Geological Survey in the *National Geographic Magazine*, Feb. 1897. The lake is deeply set in the Cascade range, about sixty-five miles north of the California line. On approaching the site of the lake the traveller sees

a cluster of gentle peaks rising about a thousand feet above the general level of the range. On arriving at the summit of the rim of the crater he suddenly comes upon a scene of majestic beauty. Twenty miles of unbroken cliffs, from 500 to nearly 2000 feet in height, surround a sheet of calm, deep-blue water. On the outer slopes of the crater are many adnate cones, and traces of glacial action are visible all over the outer slopes, striated rocks appearing even on the edge of the rim, but nowhere on the inner slope. The unavoidable inference is, then, that a high mountain (to which the name Mazama has been given) once occupied the site of the lake. The notches in the rim, evidently carved out by streams of ice and water descending from a point over the lake, are additional proofs of its existence. All the lava-flows radiate outwards from the crater, and sections of them are seen from the lake. The flow that forms the Palisades, 600 feet above the lake, bears in part glacial striæ which extend beneath the layers of pumice and rhyolite of a later eruption. Evidently, then, Mazama was an active volcano during the Glacial Period. All the older lavas exposed on the inner side of the rim are andesites, the newer ones, forming the top of the rim in Llao Rock, Round Top, etc., are rhyolites, while later flows, which escaped from the adnate cones on the outer slope, are basalts. As to the exact form and size of Mount Mazama there is abundant room for speculation. Mount Shasta and the rim of Crater lake have about the same diameter at a height of 8000 feet, and, therefore, it may be inferred that the two mountains were of equal height.

Wonderful as the lake is, still more wonderful is the enormous pit or caldera, 4000 feet deep. From the top of the rim it reaches down half way to sea-level, and nearly a square mile of its bottom is below the level of Upper Klamath lake at the eastern foot of the range. The pit has not been formed by erosion, for the lake is enclosed on every side. Nor can it have been produced by an explosion, for no fragmental deposit is found on the rim, but only masses of solid lava. More probably the molten lava, escaping by fissures, left the upper part of the mountain hollow, so that it caved in. It has been suggested, but perhaps not seriously, that the cone on the island in the lake, Wizard island, may represent the summit of the sunken Mount Mazama. But this is a cinder cone, 845 feet high and surmounted by a crater 80 feet deep, and is quite new and fresh, without any trace of weathering. The soundings that have been taken appear to indicate the existence of two other such cones beneath the surface of the lake.

The colour of the lake is deep blue, merging along the borders into various shades and tints of green. It is so transparent that a white dinner-plate, ten inches in diameter, can be seen to a depth of nearly 100 feet. Mr. B. W. Evermann, of the United States Fish Commission, observed the temperature of the water at 1 P.M. on August 22nd. At the surface it was 60° ; at a depth of 555 feet 39°; at 1043 feet 41°; and at 1623 feet (on the bottom) 46°. The rise of temperature in the lower layers suggests that volcanic heat may yet be present; but fuller observations are needed to thoroughly establish the variations of temperature.

Density of Population in Guatemala.—Dr. Karl Sapper contributes to *Globus*, Bd. lxxi. No. 12, a paper in which he discusses the density of population in Guatemala, principally in reference to climate and elevation. The boundaries of the Republic towards Mexico and British Honduras are fixed, but are not yet delimited towards the republics of Honduras and Salvador. Therefore the area can be only approximately estimated at 42,000 square miles. The population, according to the census of 1893, was 1,264,678, giving a density of 32·5 to a square mile. The distribution is very unequal, the density varying from 247·7 in the Department of Totonicapam to ·5 in Petén, which is the largest Department of

the Republic, making one-third of the whole. If Petén be excluded, the density over the remainder is 48·7, though considerable variations are still observable.

Extensive lowlands, the Petén, occupy part of the north of Guatemala ; elsewhere are mighty elevations—the ranges of Central Guatemala, which run in a gentle curve from the Mexican frontier to the Atlantic Ocean, and the massive group of South Guatemala, running for the most part parallel to the Pacific coast. As Guatemala lies in the zone of the trade winds, generally appearing here as north-easterly winds, the northern tracts receive most rain and produce the most luxuriant vegetation. The forested regions of the north are strongly contrasted by the small density of population (6·5 per square mile) from the sunny lands of the south with a density of 66·3. The northern region also includes damp, moist, and unhealthy low-lying districts, where the water is often bad and the population extremely thin. Another damp, unhealthy region lies on the southern slope of the South Guatemala mountains, which has as large an annual rainfall as Alta Verapaz on the northern side of the Republic, but a much longer dry season. Consequently the density reaches thirty-nine, against twenty-seven on the northern warm region, being also increased by the introduction of coffee cultivation during the last twenty years.

The highest mean density of population, seventy-eight, occurs in the relatively dry regions among the main range of the central mountains, and the volcanoes which here form a climatic boundary. But even in this dry region the density varies considerably, the southern slope of the range being less densely peopled than the northern, the cause being probably the greater fertility of the soil where it is mingled with volcanic ejectamenta.

When other conditions are the same, the density of population varies with the altitude. In the Altos (Guezaltenango, Totonicapam, and S. Marcos) the zone of maximum density lies about between 7200 and 8200 feet above sea-level. Above, the population thins rapidly, and apparently does not extend beyond the upper limit of agriculture, 10,300 feet. The dry regions are less productive than the hot, moist districts, but they present fewer obstacles to cultivation, besides being more healthy. The introduction of coffee cultivation on the slopes of the mountains has, however, drawn many of the settlers away from these poorer lands. Guatemala is still thinly peopled, and is capable of supporting a much larger number of persons, though its inhabitants can never be very numerous, seeing that it is a mountainous country. Dr. Sapper gives reasons for believing that the population before the conquest was not large.

The Nicaragua Canal.—An article of Dr. H. Polakowsky in the *Zeitschrift der Gesell. für Erdkunde zu Berlin*, Bd. xxxi. No. 6, is chiefly devoted to the Nicaragua canal project as modified by the late United States Commission. Of the Panama canal the author has little hope as long as it is in the hands of the present company, and he considers that at the present time, at least, the Nicaragua route has the most promise of success. It has the advantage of running through a part of Central America less subject to earthquakes than most, and requiring no deep cuttings worth mentioning. By four dams and four locks the waters of the San Juan can be gradually lowered to sea-level. In the latest plans the locks are placed close together at either end of the route, whereby the danger from volcanic outbreaks and earthquakes is decidedly increased. Several surveys have been made, one of which, by Mr. A. G. Menocal, was reported fully in vol. iv. p. 54. Others were executed at the instance of the Maritime Canal Company of Nicaragua and the Nicaragua Canal Construction Company.

The San Juan carries off the surplus waters of the Managua and Nicaragua lakes, which receive the drainage of 11,350 sq. miles of country, while the valley

of the river has an area of 3980 sq. miles. On leaving the lake near Fort San Carlos the stream has a breadth of 260 yards and is 10 feet deep. Its discharge is 1000 to 1200 cubic feet, according to the season. The length of the San Juan is 118 miles, and its fall 100 feet; but this is unequally distributed, and, except in the rapids, is from about ·08 to ·11 feet per mile. Along the first fifty miles of its course the San Juan forms four rapids. Forty-eight miles from the sea it is joined by the tributary San Carlos, and three and a half miles below the confluence the great Ochoa dam would be constructed, which would raise the river to the height of the Nicaragua lake, and cause it to flood part of its valley, so that the Machuca and Balas rapids would be covered with sufficient water for the passage of vessels drawing twenty-eight feet, while at the Castillo and Toro rapids rocks would have to be removed by blasting, as well as along the upper part of the canal.

The Commission fixes the depth at 30 feet and the breadth at 82 yards, and in the windings of the stream at 100 to 130, so that the largest vessels may pass with ease. Nor does it consider a fall of four feet between the lake and the dam, as planned by the Maritime Canal Company, advisable, and therefore would raise the dam so that the whole canal should be 108 feet above sea-level, and have a perfectly level surface. Several also of the windings of the channel must be removed, and these alterations of the plan would entail great additional labour in removing rock and earth. Consequently, while the Maritime Canal Company estimated the cost of canalising the San Juan at $1,970,000, the Board reckons it at $14,860,000.

In the Nicaragua lake the first fourteen miles from the San Juan must be deepened, and the Commission considers that the breadth of the channel at the bottom should be 295 feet instead of half that breadth, as fixed by the Company. Fully 318 million cubic feet of mud and solid matter will have to be dredged up here. Farther out in the lake and up to the west coast there is a depth of from 30 to 150 feet. The route leaves the Balsillas islands to the north and the Solentinawe and Sonate islands to the south, and passes the south end of Ometepe island at a distance of about four miles. To the west and south of this island, with the volcanoes of Madera and Ometepe, there is good and ample anchorage for the largest vessels. The west coast of the lake is rocky, and the contour of 30 feet runs at a distance of 525 yards from the strand. Two dams must be constructed at the canal entrance, 590 and 790 yards long respectively, and the Commission proposes that these should stand 260 yards apart at the shore end and only 165 at the east end.

The western section of the route is the most thoroughly surveyed, and the trace may be considered as definitely fixed. Leaving the shore of the lake 300 yards north of the mouth of the Lajas it crosses the river four times within the distance of one and a half miles. A special canal must be constructed to keep the water of the river on the south side of the ship canal. The watershed lies about five miles from the lake at a height of 152 feet, or 43 above the uppermost level of the canal, so that the cutting will be only 73 feet in depth. Beyond, the valley of the Rio Grande is entered, which the trace of the canal follows as far as Brito, seven and a half miles from the lake. It was proposed to dam up the river at La Flor so as to form a large basin 4000 acres in area; but the want of good foundations, and difficulties connected with the river Tola, have caused the Commission to choose the south side of the Rio Grande, thus avoiding the Tola altogether. Part of the water of the Upper Rio Grande would be taken into the canal and carried to the lake or the ocean. Three locks would be built on this section and a flood lock with a fall of twenty-four feet at half tide. Several points, however, have still to be investigated, as, for instance, the discharge of the Rio Grande.

The alluvial valley of the Rio Grande reaches the coast at the harbour of Brito. The hills which enclose the valley of the Rio Grande send out promontories into the sea about one and a half miles apart. The prevailing wind is the north-east, and, though storms are rare, the long, huge waves of the Pacific raise a line of surf even in calm weather. From the western promontory, which runs 490 yards into the sea, it is proposed, therefore, to construct a breakwater parallel to the coast and 1180 yards in length. A short jetty at right angles to the former is to run out to a length of 260 to 300 yards, leaving an entrance 260 yards broad. One hundred acres of the enclosed harbour are to be dredged out to a depth of thirty feet at low water, and this anchorage may be enlarged afterwards. But as this harbour will not be thoroughly protected from stormy weather, a smaller one must be constructed within, where coaling and repairs may be carried on.

At several points along the route of the canal further investigations are necessary, for instance in the harbour of Brito and the neighbourhood, the lake and the San Juan river, and the whole eastern section from Ochoa to Grey Town ; and the rainfall should also be observed. For this preliminary work at least eighteen months will be required.

While the Maritime Canal Company estimated the total cost of the canal at $66,460,000 the United States Commission puts it down at $133,470,000.

GENERAL.

Meteorological Observations in Balloons.—On November 17th a series of international investigations of the atmosphere was inaugurated by the simultaneous ascent of balloons from several towns on the Continent. The following table shows the maximum heights reached, and the lowest temperatures recorded :—

	Height in feet.	Temperature F.	
St. Petersburg	16,400	− 11°	− 17·5° at 14,100 ft.
Warsaw	6,560	− 4°	
Berlin	19,700	− 14°	
Do.	18,540	− 12°	Warm air below 10,000 ft.
Strasbourg	25,260	− 22°	− 22° at 19,700 ft.
Paris	49,200	− 76°	
Munich	11,480	+ 20°	

These observations represent the conditions prevailing in the midst of a large area of high pressure that was moving slowly eastward over Europe. At Strasbourg and Berlin a layer of warmer air was passed before the balloons ascended into the colder air above. At 7 A.M. on November 14th the central isobar of 30·12 inches extended from Finland to Greece, and at 9 P.M. the isobar of 30·3 inches extended from St. Petersburg to Bulgaria. The sky was generally cloudless during the balloon ascents, but cloudy weather soon followed, with continued cold at the Earth's surface and high pressure from France to the Urals. To the north of this belt temperatures were not abnormally low. Evidently this ridge of 30·5 to 30·9 inches, extending from north-west to south-east between two low pressure areas, represented the slow descent of cold dry air, which flowed away in all directions. The sea-level pressures and temperatures could have resulted from a general eastward movement and very slow descent of the layer of cold upper air that was reached by the balloons on the 14th ; it finally moved south-eastwards towards Persia.—*Monthly Weather Review*, November.

The Mean Density of the Earth.—Professor Franz Richarz and Dr. Otto Krigar-Menzel have determined the attraction of the Earth by a new method of weighing.

From the scales of a sensitive balance wires several yards long hang down and support another pair of scales at their extremities. A weight placed in one of the lower scales is of course subject to a greater attraction than when placed in one of the upper scales, and the difference is sufficiently large to be indicated by the balance. But greater precision in the determination of the force of gravity has been obtained by placing between the two pairs of scales a cubical mass of lead weighing 220,000 lbs., which increases the downward attraction of the upper scales and diminishes that of the lower pair. By numerous observations of the acceleration, with and without the mass of lead, the gravitation constants were determined and the mean density of the Earth calculated to be 5·05. The result agrees closely with the value found by other observers (Dr. Poynting's determination was 5·493 ; see vol. x. p. 276), but it is claimed that this method is more reliable than any other.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xl. Nos. 1 und 2.

MISCELLANEOUS.

The **Versammlung Deutscher Naturforscher und Ärzte** will be held this year in Brunswick from the 20th to the 25th of September.

The rainfall of **Trinidad** seems to be slowly but steadily diminishing. In the ten years 1862 to 1871 the annual fall was 62·5 inches on an average ; from 1872 to 1881 it was 61·8 ; and from 1882 to 1891 only 60·8.

The **International Geological Congress** will take place in St. Petersburg at the end of June, under the presidency of M. A. Karpinski. Before the Congress excursions will be made to the Urals, the banks of the Volga, and Esthonia. After the meeting parties will visit Finland and the Caucasus.

On p. 207 it was inadvertently stated that **Johannesburg** was the second largest town in "the continent of Africa." For the words in inverted commas "South Africa" should be substituted. There are, perhaps, ten or a dozen towns in Africa with a larger population, Cairo and Alexandria taking the lead. If the suburbs be included, Johannesburg takes a high place in the list of African towns.

Some Japanese have lately climbed **Mount Morrison** in Formosa. Its height is 13,800 feet. Up to a height of 6000 feet it is clothed with cedar forests, while above are chasms and bare rocks. Snow was not seen. The temperature throughout the ascent was rather high, and at the summit the thermometer marked 72·5° F., on November 18th. The mountain bears no indication of a volcanic origin ; it is formed of metamorphosed sedimentary rocks, and granite appears only at the summit.—*Globus*, Bd. lxxi. No. 15.

The new number of the *Annals of Scottish Natural History* contains papers on "The Wild Cat of Scotland," by Dr. E. Hamilton ; a "List of the Birds of Berwick-on-Tweed," by Mr. George Bolam ; "On the Occurrence of the Frigate Petrel on the West Coast of Scotland," by Mr. Eagle Clarke ; "Notes on Lepidoptera collected in the Edinburgh District," by Mr. W. Evans ; "On the Flora of Eigg," by Mr. Symers M. Macvicar ; and "New and Rare Scottish Mosses," by Dr. J. Stirton ; besides the usual notes and reviews.

Four-fifths of the **platinum** used in the world comes from the Ural mountains. In 1880 the output was 6493 lbs., after which it rose gradually till it reached 11,478 lbs. in 1894. In 1895 only 9726 lbs. were extracted, the summer being wet. Platinum in a rough state is sold in Russia for about 210 shillings a pound. It is refined in Germany. With it iridium is found in small quantities ; about

9 lbs. were obtained in 1894 and very little more in the previous year.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xl. Nos. 1 und 2.

The first submarine **telegraph cable** was laid between England and France in 1851, and now there are 1300 cables with a total length of fully 162,000 nautical miles, of which 18,000 miles are the property of various governments, while 144,000 belong to private companies. Forty-one vessels, of an aggregate measurement of 60,000 tons, are engaged in repairs. Twenty-five years ago fifty or sixty messages of ten words each were sent in an hour, whereas at the present day 1000 such messages can be transmitted in the same time.—*Revue Scientifique*, March 6th.

The island of **Saghalin** presents a curious meteorological anomaly. It is washed by two cold sea currents, and in winter is exposed to glacial winds from the north-west. Consequently at sea-level snow continues to fall up to the end of May, while in the higher country the climate is milder. In Siberia and Central Europe also cold air has been found to accumulate in the valleys, owing to its density, and this is what happens in Saghalin. The beech, birch, maple, pine, and fir form almost impassable forests on the low grounds, while on the higher lands bamboo, hydrangeas, *Araliaceæ*, *Petasites*, and other plants testify to the abnormal climatic conditions of the island.—*Ciel et Terre*, January 1st.

Mr. George H. Barton, who accompanied the party under Professor Tarr, which was attached to the last **Peary Expedition**, has contributed a paper to the *American Geologist*, December 1896, on the *Former Extension of Glacial Action on the West Coast of Greenland and in Labrador and Baffin Land.* At Turnavik on the Labrador coast the whole country is well rounded to the highest summits, fine *roches moutonnées* being numerous. The striæ still visible for some distance above sea-level indicate a movement of the ice-sheet from about north-east. Similar indications were observed near Disko and in the Karajak fiord. This year also scientific parties will accompany Mr. Peary to Greenland, and all of them will devote their attention to glacial action. Mr. Barton hopes to investigate the Umanak fiord.

The American Museum of Natural History is about to undertake a systematic exploration of the peoples inhabiting the coasts of the **North Pacific Ocean** between the Amur and the Columbia river, for which funds will be supplied by Mr. Morris K. Jesup, President of the Museum. Some authorities have maintained that American culture grew up spontaneously, while others claim for it an Asiatic origin. In the latter case there are two routes by which Asiatic arts may have reached America—over the islands of the Pacific and across Bering Strait. The problem to be taken up by the museum relates to the northern route. Its difficulties may be to some extent appreciated when it is stated that between Columbia river and the strait ten languages fundamentally distinct, with thirty-seven dialects, are spoken, and that on the Asiatic side there are seven distinct languages spoken in at least ten dialects, not one of which is intelligible to those tribes who use the others.—*Science*, March 19th.

NEW BOOKS.

The Cities and Bishopries of Phrygia, being an Essay of the Local History of Phrygia from the Earliest Times to the Turkish Conquest. By W. M. Ramsay, D.C.L., LL.D., Hon. Member Arch. Soc., Athens; formerly Fellow of Exeter and of Lincoln College, Oxford; Professor of Humanity, Aberdeen; formerly Professor of Classical Archæology, Oxford. Vol. I., Part II.: West and Central Phrygia. Oxford: at the Clarendon Press, 1897. Pp. xvi + 440 [= 792 – 352]. *Price* 21*s. net.*

The first part of the first volume of this scholarly work was reviewed at some length in this Magazine (December 1895), and it is unnecessary to repeat what was then said as to the scope of the work, the qualifications of the author, and the value of the contribution he brings to the geography and history of Phrygia as the fruit of exploration and studies extending over many years. The second part, which completes the first volume and the larger portion of the work, deserves an even heartier welcome and warmer commendation from us than the first. Professor Ramsay himself feels that he has done better than in the first part, and his impression seems to us correct. Those aspects of his subject with which he has been dealing have possessed for him more attraction and more of human interest, and have called forth an enthusiasm and unflagging ardour which enliven the minute and dry details of topographical research. This part is occupied chiefly with West Central Phrygia, including the upper Mæander Valley (where Apameia forms the centre of interest), and several well-defined tracts lying to the north of this valley in the undulating plateau now called the Banaz-Ova, the Akmonian District, and the Pentapolis of Phrygia. Numerous topographical questions of varied interest and importance arise in connection with every one of these districts, in dealing with which Professor Ramsay impresses us strongly with his openmindedness, his eagerness to adjust his theories to the evidence available, and his common-sense regard for the visible configuration of the country, and for the lines of communication which natural features inevitably dictate and have compelled men to use from the earliest to the latest times. Where he sees good ground for a definite decision, his opinion is felt to carry weight, and deservedly so. Perhaps in this department he is seen at his best in the long and thorough discussion, in admirable temper, of the data for the identification of the various streams which pass through or near Apameia—a subject of considerable interest, regarding which there has been no little conflict of opinion, and some lively controversy.

But of far higher importance and deeper interest than these questions are those raised by the Jewish inscriptions in Phrygia (especially at Akmonia), which form the subject of chap. xv., and by the Christian inscriptions in South-West and Central Phrygia, to which are devoted chaps. xii. and xvii. In regard to the Jews, the evidence places it beyond doubt that in Phrygia they were numerous, wealthy, and highly favoured: on the one hand their morality and the exclusiveness of their religion exercised a powerful and beneficial influence on the people among whom they dwelt; but, on the other hand, they approximated more than Jews elsewhere to the Græco-Roman civilisation, and so far relaxed their exclusive standard as to join in the imperial cultus, and even to hold office as priests of that cultus. The inference is drawn, and it seems sound, that they were probably largely Christianised at an early period, and in the end became merged in the surrounding population.

The Christian inscriptions under the thoughtful and incisive commentary of Professor Ramsay are found to throw a flood of light on many questions of great interest connected with the early history of Christianity. The centres where it first took root, its gradual diffusion, and the lines along which it spread, the relations between Christians on the one hand and their pagan fellow-countrymen and the imperial authorities on the other, the absence of any break between Greek and Christian culture, and the slowness with which distinctively Christian formulæ, ornamentation, and social forms grew up—these, and others like these, are topics which find pertinent illustration from the inscriptions, and are invested by Professor Ramsay's comments with an unmistakable charm. It seems impossible to resist the conclusion, for which he adduces much indirect evidence, that in the end of the second, and all through the third, century there existed practically peaceful relations between the adherents of hostile religions—the result of mutual forbearance, and especially of the avoidance on the part of the Christians of anything in their public appearances and inscriptions which could be construed as a defiance of the authority of the Government, and provoke to the application of the laxly enforced but still operative laws which forbade the very existence of Christianity. But from the beginning of the fourth century there is a great change. The rich intellectual and political life of the Christians, as witnessed to by the inscriptions of Eumeneia, disappears. The life of that city was permanently and irreparably destroyed. Other causes had been tending to produce this result; but it seems impossible to resist Professor Ramsay's conclusion that the only adequate explanation of the sudden disappearance of the active and progressive section of the population is to be found in the thorough-going massacre, carefully planned and deliberately carried out under the orders of Diocletian, which thus had most disastrous effects, not only for Christianity, but for the cause of civilisation and general culture in Phrygia. Many of the inscriptions have a profound human interest, and will reward careful study, as Professor Ramsay's commentary shows. Perhaps the most notable is that of Avircius, the presbyter (or bishop) of Hierapolis in the Pentapolis, which was discovered by Professor Ramsay, and has led to so much controversy on both the exact text (where the stone has suffered) and the meaning. In regard to both these matters Professor Ramsay's attitude and guiding principles seem to us thoroughly sensible and sound. Hardly less interesting is the non-Christian inscription of Gaius on page 386, which is a remarkable product of the philosophic reaction in the third century, in pointed opposition to Christianity, but borrowing from it a finer moral tone and a tinge of spirituality.

As Professor Ramsay has still a considerable part of his work before him, we venture to make a suggestion, the adoption of which will be found, we are sure, very helpful to readers who come to the perusal of his book without the thorough knowledge of the subject which he possesses, and which he is tempted to assume that all who have recourse to a work of this character will possess. The suggestion, which arises out of our own experience in perusing the section on the towns in the Banaz-Ova, is that, before attempting to identify the sites of ancient towns and villages, he should always first state briefly what information is to be extracted from ancient geographers, casual references in literature, route-books, etc., in regard to the towns of the district, their relative position and importance, and, having done so, should then say what sites seem to answer to the conditions. If his view differs from that of another scholar he might occasionally add his reason for being unable to agree with him, but generally the statement of his reasons for his own view would suffice, and, in any case, the reader having all the data before him, would, to some extent, be able to judge for himself. Occasionally Professor Ramsay has begun by stating the view he does not support, and then proceeds to

argue against it. This method of handling the question is decidedly not conducive to clearness and intelligibility, while it unnecessarily accentuates differences, and gives a wrong impression of his attitude. Further, Professor Ramsay, it seems to us, could afford to ignore and to treat with contemptuous silence some of the carping and ungenerous criticisms he notices, and to which he occasionally replies. At times he is too anxious to refute and convince opponents who do not deserve to have time and strength spent upon them and their theories. Let him calmly say what he thinks, and why, and then leave the matter to its fate. Truths will in the end prevail with those whose assent is worth caring for.

The Latin Kingdom of Jerusalem, 1099 *to* 1291 *A.D.* By Lieut.-Colonel C. R. Conder, LL.D., M.R.A.S., R.E., author of *Tent Work in Palestine, Heth and Moab*, etc. London: The Palestine Exploration Fund, 1897. Pp. viii + 443.

The author has set himself a task of no little magnitude—a task which may be said to have a threefold object. In the first place, he narrates the history of the rise and fall of the Latin Kingdom in Palestine, including the events that led to the crusades, and the conditions in Europe which affected the fluctuations in the fortunes of the kingdom. His second, and professedly chief, aim, is to give a picture of the internal administration of the kingdom, and of the curious social conditions which resulted from the establishment of a feudal society amid Oriental surroundings, utilising for this purpose a large amount of material collected by antiquarians in France and Germany, and the information gained from the recent survey of Palestine. In the third place, he describes the results, far-reaching and important, from the establishment of the kingdom, on the progress of culture and civilisation generally in Europe. A really satisfactory accomplishment of this task could be expected only from a man who, having made a life-study of European history, especially in the mediæval period, could put his finger on the various causes which influenced the course of events, and discriminate roughly the share of each in the result. This is a qualification that Colonel Conder cannot be said to possess. His laurels have been gained on other fields. It is therefore not a matter for surprise that his success has been only moderate. He has unquestionably gone carefully through the original authorities for the history of the crusades, and has quoted many interesting facts from the documents recently collected by antiquarian research; but we do not find that there is any addition of substantial value to what is stated in other histories of the crusades. Nay, too often the result of his industry is a collection of scrappy, unconnected facts, which are told in a not very attractive style, and, as they do not combine to form a comprehensive and intelligible picture, weary more than they interest or enlighten. It is, however, rather from a not infrequent inexactness of expression in the references to General Political and Literary History that one gets the impression that the author is handling subjects which he has only lately tried to master and is not yet at home in. What, for instance, are "Analectics," the first subject said to be treated in the philosophic writings of Bar Hebræus? Can "Analytics" be meant? Again, it is inexact to speak of "the Angevine dominions as including the kingdoms of England, Scotland, and Ireland," and when he writes, "Meanwhile the wisest of the Syrian orders became the scapegoat for the sins of Europe," we are utterly at a loss to understand how Philip the Fair's attack on the Templars, that he might appropriate their wealth, can be thus described, or what really is meant. It is very natural, then, that one is not very ready to accept without question the ambitious generalisations in which the author indulges under the third branch of his subject, and of which the following are samples:—"The result of the crusades was the Renaissance"; "The fortunes

of the Church of Rome (by which, as another passage shows, is meant the Papal Power) waxed and waned with the fortunes of the Latins in the East"; "The Communes appeared first in Syria and gained strength later at home." In each of these generalisations there is an element of truth long since recognised and stated by others of deeper knowledge; but it is here so exaggerated as to be misleading. That the work has commendable features, and is the product of industrious study of the original authorities, must be admitted, but neither in style, nor graphic power, nor philosophic grasp, does it come up to the standard the subject deserves.

The Fall of the Congo Arabs. By Sidney Langford Hinde. London: Methuen and Co., 1897. Pp. 281. Notes, Index, Map, 2 Portraits, and various Plans. *Price* 12*s.* 6*d.*

If any one wishes for a ghastly, gruesome account of bloodshed, brutality, and cannibalism, he cannot do better than read this book.

The author, a young doctor, went as medical officer to the Congo in 1891, and was attached to Baron Dhanis' expedition to free the Congo State of the slave-dealers, and to drive back the Arab power, which threatened to become a species of Madhiism at the headwaters of the Congo. With the exception of a note on the exploration of a section of the Lualaba river, there is little geographical information in the book, which, lightened here and there by a few brief descriptions of country and people, deals almost solely with the extraordinary military operations which were rendered necessary by the threatened invasion of the Congo State by the Arabs. It is a wonderful record of pluck: eight or ten white men, 400 regular troops (Hausas), aided by thousands of native auxiliaries, fighting against tremendous odds through jungle and marsh and impenetrable forest. The fights were exceedingly fierce; it is estimated that some 70,000 Arabs were killed, and for the most part eaten; and our author, whilst not approving of the cannibalism, seems to think that at any rate it prevented a considerable number of epidemics.

His descriptions of a caravan road (p. 35), of the system of signalling by means of drums (p. 59), and of the little people of the forest, are interesting, but one cannot say that the account is a pleasing one to read, although it is doubtless important that true narratives should be written of such expeditions. That this expedition was necessary there can hardly be any doubt, for the Arabs, firmly established at Kasongo and Nyangwe, were devastating the whole country, and were intending to make a descent of the Congo and drive the white men from the field. Had this taken place, a great Arab kingdom would inevitably have been formed, and a state of matters even worse than at present obtains in the Sudan under the Kalifa's rule would have been inevitable.

Captain Hinde is to be congratulated on having survived so many perils, and on having taken part in breaking the neck of the Arab rising.

Im Osten Asiens. Von Otto E. Ehlers. Mit zahlreichen Illustrationen und zwei Karten. 3 Auflage. Berlin: Allgemeiner Verein für Deutsche Litteratur, 1896. Pp. viii + 391. *Price* 6 *M.*

A melancholy interest attaches to this volume, as the posthumous work of a distinguished traveller and agreeable writer, who, as the reader may recollect, was drowned while crossing a river in New Guinea in 1895.

The journey here described includes Hongkong and the chief ports of China, an excursion from Pekin into Mongolia, and a short visit to Corea. The book is only a record of passing experiences, but the writer was evidently a man of keen and

practised observation. He had, besides, access to the best European information, and competent interpreters. At all events, whatever the value of his conclusions, he gives us a series of lifelike pictures in a characteristic style, full of movement amusing and incisive.

There is doubtless a thick wall of mutual non-comprehension between the European and the Chinaman. Dr. Ehlers asserts roundly that he has "Kein Herz, kein Gefühl"; and he quotes with approval the complaint of his little thirteen-year-old Indian servant from Mauritius, "Les Chinois sont mauvais; il n'ont pas de sentiment!" But we do not know what the other side may say. Some of those, too, whom Dr. Ehlers met, seem to have been very fairly human.

The great interest of Pekin, he says, is not commonly appreciated by travellers. He finds it as interesting as it is dirty, and the dirt, he says, baffles description. He describes an amusing interview at Tientsin with the great Viceroy Li Hung Chang, and speaks very highly of the military school and arsenal there—writing before the war. In Mongolia the Great Wall makes a profound impression, as do the vast caravans of two-humped camels—an animal "every way superior," he tells us, to his one-humped cousin. But he is especially fascinated by Corea, with its peculiar customs, ceremonies, architecture, and costumes, the result of long isolation. He likes the people, too, though in personal filthiness they eclipse even the Chinamen, and his graphic description of them and their surroundings is perhaps the most interesting part of a very attractive book.

Autour de la Méditerranée. Les Côtes Latines. La France, de Port-Vendres à Vintimille. Par MARIUS BERNARD. 145 Illustrations par A. CHAPON. Paris: Henri Laurens, 1896. Pp. 400. *Price* 10 *F.*

This is only part of an extensive and important illustrated work, describing the shores of the Mediterranean in three series, viz., the Barbary, Latin, and Eastern shores. Three volumes are devoted to each series, and this volume describes the French Latin shores, extending from Port Vendres on the frontier of Spain to Mentone, the last frontier town of France. It furnishes a graphic, interesting, and instructive account of the country washed by the "Golfe du Lion," and also that forming the French Riviera. It also embraces the Island of Corsica, which, although Italian in everything else, is a French possession. The author's map enables us to see his route, and from it we infer that he missed seeing some of the most picturesque parts of Corsica, notably the district between Ajaccio and Calvi. He also seems to confuse "Napoleon's Grotto" (or Grotte du Casone), which is close to Ajaccio, and the "Jardin des Milleli," the Bonapartes' country house, which is some miles from Ajaccio. It will doubtless surprise the author to learn that, in the opinion of one of the latest and best biographers of Napoleon, the house shown in Ajaccio as Napoleon's birthplace is not the one in which Napoleon was born, the weight of evidence, according to that biographer, tending to prove that the Paolists both looted and burned the original house. It is so easy, in a place like Ajaccio, where interest and credulity combine for that purpose, to create a convenient legend, that the subject should be investigated by competent and impartial authorities.

Lazy Tours . . . in Spain and Elsewhere. By LOUISE CHANDLER MOULTON. Ward, Lock, and Co., 1896. Pp. x + 377. *Price* 6*s.*

Pleasantly written, this is a collection of papers of various dates, presumably contributed in the first place to American periodicals, and describing several well-known resorts in Western Europe. From the point of view of geography little

need be said, except to point out the mis-spellings of (p. 5) "Plessis *la Tour*," of "Sierra Nevadas" (p. 34, 35, and 38), and of "Las Delicios" (p. 44). And since the writer shows (p. 250) she is well aware "that Mont Blanc, which we are wont to speak of as in Switzerland, really belongs to Savoie," would it not have been more consistent if she had included her chapter on "Chamouny and the Mer de Glace" under "Lights and Shades of Travelling in Savoie," instead of among the "Rambles in Switzerland"? Why, also, should King Humbert's name be spelt "Humberto," which is neither English nor Italian? But these are errors of no very great consequence, and they do not alter the fact that the general reader will derive much pleasure and instruction from this genial and brightly written book.

Reisen in Nord- und Zentral-Persien. Von A. F. Stahl. Ergänzungsheft zu Petermanns Mitteilungen, No. 118. Gotha: Justus Perthes, 1896. Pp. 39. *Price M.* 4.40.

The author, A. F. Stahl, late Postmaster-General of Persia, has laid tourists and geographers under a great obligation by publishing this account of his travels in Northern and Central Persia. It consists mainly of an accurate description of the principal roads in those parts. Travelling in Persia, we are told, is on the whole quite as safe as in Europe, and, this being so, we hope that the large blanks which the map of Persia still presents will soon be filled up. The country seems to be greatly in need of European capital and enterprise. There are minerals which it would pay to work, and large tracts of land which are barren only for want of irrigation. We notice that Herr Stahl gives the height of the Demavend, according to Russian trigonometrical measurements, as 5670 mètres, with which, he says, the later hypsometrical measurements of Dr. Sven Hedin agree, whereas the latter gives the height as 5465 mètres (*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xix.). The author accompanies his description by three excellent maps, on which his route is carefully traced, and the situations of inhabited places marked according to measurements carried out by himself, or derived from reliable sources. The occurrence of minerals is also indicated.

Durch Armenien, Kurdistan, und Mesopotamien. Von Dr. P. Müller-Simonis. Mainz: Verlag von Franz Kirchheim, 1897. Pp. 344. Map, 7 full-page Photogravures, and 104 Illustrations. *Price M.* 12; *bound M.* 15.

Now that Armenia is exciting so much interest, we can recommend this book as giving an excellent account of the geography, ethnology, history, and archæology of that country, and of the adjacent Kurdistan and Mesopotamia.

Dr. Müller-Simonis, accompanied by Professor Dr. H. Hyvernat, journeyed through these countries from August 1888 until February 1889. They travelled from Constantinople to Tiflis, then to Erivan, then to Julfa, to Urmia and Van; then to Aganz, Bitlis, Saïrd, and Jezireh. From there they proceeded to Mosul, and *viâ* Korsabad to Bagdad; then to Babylon, returning to Bagdad.

This is a most valuable book, as, apart from the account of the journey—which is in diary form,—the archæological information which it contains is of extreme importance. The illustrations could not be better, and the woodcuts, which are either reproductions of photographs or drawings of Dr. Müller-Simonis, add greatly to the value of the book. The author gives a sketch of the Oriental Church, as well as of the Pope's endeavours for union. After reading the volume, the condition of the people and the political situation in Armenia become much more comprehensible than before.

De Marseille au Paraguay. (Notes de Voyage.) Par Édouard Deiss. Paris: Librairie Léopold Cerf, 1896. Pp. 226. *Prix 3 fr. 50.*

While these notes of travel contain nothing especially new or important, they are of interest throughout. Leaving Marseilles on 2nd July, the steamer in which M. Deiss sailed arrived at Rio de Janeiro on the 23rd, and, after a stay of several days there, continued her voyage to Monte Video and Buenos Ayres, at which latter place M. Deiss disembarked. He then visited the principal points of interest in Argentina, penetrating as far as Tucuman, whence he returned to Rosario, and, after an inspection of Santa Fé and Paraná, proceeded up the river to Asuncion. From Asuncion he visited Monte Claro and Villa Rica, and spent some days at an estancia in the neighbourhood of the town last named. Thereafter he returned to Asuncion and Buenos Ayres, where his South American experiences came to an end. The descriptions of scenery and of the various industries and manufactories inspected by M. Deiss are graphic, precise, and instructive; but it is to be regretted that there is nothing in the shape of a map to indicate the route. The last thirty or forty pages of the book are occupied with a useful bibliography of works relating to Brazil, Argentina, and Paraguay. It may be added that the author, in more than one passage, shows that he suffers from Anglophobia in its acutest form.

Geschichte der Isländischen Geographie. Von Th. Thoroddsen. Autorisierte Uebersetzung von August Gebhardt. Erster Band. *Die Isländische Geographie bis zum Schlusse des 16 Jahrhunderts.* Leipzig: B. G. Teubner, 1897. Pp. xvi + 237.

The *Proceedings* of the Icelandic Literary Society for 1892 contains the first part of a History of Icelandic Geography, written, of course, in Icelandic, by Th. Thoroddsen. To Dr. August Gebhardt we are indebted for the very readable German translation recently published at Leipzig. Though intended for the general reader, the book is written in a thoroughly scientific spirit, and forms a very interesting and valuable contribution to the science of geography. The first part, which only takes us as far as the close of the sixteenth century, does not, as might be expected, record any scientific investigations; its interest lies chiefly in placing before us the popular ideas entertained with regard to Iceland in the Middle Ages. The island does not seem to have been known to the ancients, their Thule, doubtless, not referring to Iceland. It does not even seem to have been inhabited before the eighth century, when Irish monks settled there. A century later the Northmen took possession of it, and their sagas frequently mention it. The information they supply is, however, very scanty; nor do we meet with more satisfactory accounts in the historical works of writers like Adam of Bremen, Giraldus Cambrensis, and Saxo Grammaticus. Saxo, it may be noted, mentions the movement of the glaciers. Owing to the commercial intercourse with Germany and England in the fourteenth and fifteenth centuries, Iceland must have been well known to the Germans and English of that time; but they have left us no account of any value. In 1544 Sebastian Münster gave a pretty accurate description of the island in his well-known Cosmography, and about ten years later Olaus Magnus published a map which seems to have been largely used by later writers. But it was only towards the close of the sixteenth century, when along with the reformation of the church there was a revival of literary studies in Iceland, that learned Icelanders began to interest themselves in the geography of their country, and the greatest scholar of his time, Bishop Gudhbrandur Thorlaksson, was also the first scientific geographer of Iceland.

We feel sure that all those who have perused this first volume of our learned author's History will be eagerly looking forward to its continuation, and we have no doubt that an English translation of the History would meet with a hearty welcome.

Industry in England: Historical Outlines. By H. de B. Gibbins, M.A. With Maps, Tables, and a Plan. London: Methuen and Co., 1896. Pp. xix + 479. *Price* 10*s.* 6*d.*

Six years ago Mr. Gibbins ventured forth on the subject of the volume before us in his *Industrial History of England*. That work has gone through several editions, we are informed; and in spite of some errors in fact and indiscretions in judgment, the success has, on the whole, been well deserved. The present volume is something more than a mere expansion of the earlier work. It is at least three times the size; it treats of many subjects only incidentally touched upon before; it is better informed; and the tone of the book, though not yet faultless, is vastly improved. The author cannot lay claim to much originality, and his reading has perhaps been too widely diffused, but he presents his facts lucidly, and succeeds fairly in sustaining the reader's interest in a subject which is dealt with—almost of necessity—in a rather disconnected manner. Mr. Gibbins recognises that the significance of the industrial development of England cannot be realised except in connection with the general growth of the nation and with its various vicissitudes, and yet we nowhere feel that he is thoroughly familiar with our history: there is not, for example, a single sentence which goes to the root of feudalism: there is nothing but commonplace on the American Question. The best part of the work is that which treats of modern times—since the Industrial Revolution. The thirty pages on pre-Roman and Roman Britain, and the forty on the Manor and Domesday Book, might have been curtailed—the former especially—in view of the less abstruse nature of the rest of the work and its average character. As a popular work the book deserves recognition.

Ocean Passages. Compiled from the various Admiralty Sailing Directions by Captain R. Jackson, R.N.

The Principal Winds and Currents of the Globe; also Rainy Seasons, Ice Limits, Fogs and Rollers and Revolving Storms. Compiled from the various Admiralty Sailing Directions, Weather Charts, etc., by Captain R. Jackson, R.N. London: Simpkin, Marshall, and Co., 1896. *Price* 1*s. each.*

In these pamphlets are collected details on the directions followed by vessels sailing to different parts of the world, the dangers to be avoided, the winds and currents and the seasons when they are most prevalent or strongest, and various other items of information. Having been approved by the Board of Trade as text-books for the Mercantile Marine, they have no need of our commendation, and all we can do is to make them known to our readers by this short notice.

Bennachie. By Alex. Inkson M'Connochie. Second Edition. Aberdeen: Lewis Smith and Son, 1897. Pp. 136. *Price, boards,* 1*s.*; *cloth,* 2*s.*

The original work was noticed in the *Magazine* seven years ago. In the new edition some of the concluding chapters on the "Neighbours" of Bennachie, "Its Castles and Mansions," and "The Battle of Harlaw" have been replaced by small paragraphs in the other chapters, where also many small improvements have been introduced. It is a book that should be obtained by all visitors to the hill.

NEW MAPS.

EUROPE.

ENGLAND AND WALES, Tourists' Map of ——. Northern and Southern Sections. Bartholomew's Reduced Ordnance Survey. North Wales and Cornwall. *Price, cloth, 2s. each.* *The Geographical Institute, Edinburgh.*

GREECE, CRETE, ETC., Map of ——, to illustrate the Eastern Question. *Price, 2s.* *W. and A. K. Johnston, Edinburgh.*

Besides a large map of Greece, several insets are contained in this sheet, one of Crete being on the scale of 10 miles to an inch. This is a very useful publication at the present crisis, as the places mentioned in the despatches from the seat of war in Thessaly—the pass of Milouna, Damasi, Nezeros, etc.,—are marked.

ASIA.

INDIA. Indian Atlas. Whole Sheets, 7, 14, 48, 61, 79, 103, 108, 109, 121. Quarter sheets, 9 NW., 21 SE., 23 SE., 26 NE., 35 SE., 38 NW., 48 NW., 49 SW., 50 SW., 59 NW., 60 NE., 66 NE. and NW., 67 SE., 69 NW., SE. and SW., 70 NE., 105 NW., 114 NW., 125 NW., 126 SW.

India. Scale 1 in. = 128 m.

Railway Map of India (Railways up to October 1895). 4 sheets. Scale 1 in. = 48 m.

Punjab and Kashmir. 4 sheets. Scale 1 in. = 16 m.

Gujarat. Scale 1 in. = 16 m.

Bengal, Bihar, Orissa, and Chota Nagpur. Scale 1 in. = 64 m.

Upper Burma, 1894. 2 sheets. Scale 1 in. = 16 m.

Presented by the Survey of India.

AFRICA.

CAPE OF GOOD HOPE, Map of the Colony of the —— and Neighbouring Territories. Compiled from the best available information, 1895. Scale 1 : 800,000 or 12·6 miles to an inch. J. Templer Horne, Surveyor-General.

Presented by Thomas Muir, Esq., LL.D., Superintendent of Education, Cape Town.

A map measuring fully six feet by four, and embracing the country as far north as Vryburg. Hills are shown in brown, and railways, roads, etc., are marked. The names are so numerous and so close together that without the help of a gazetteer it would be difficult to find places of lesser note. Certainly no other map of the Cape contains anything approaching the amount of information collected here.

ATLAS.

ATLANTE SCOLASTICO per la Geografia Fisica e Politica. Di Giuseppe Pennesi. *Prezzo L. 7.50.* *Istituto Cartografico, Roma.*

The first part of this atlas was noticed in 1894 (vol. x. p. 168), and the general description there given need not be repeated. In the present complete issue there are several additions and improvements, as, for instance, a small geological map of Italy, and a series showing the isotherms for January, July, and the whole year, rainfall, vegetation, and density of population. As a rule the maps are well up to date (the new boundary of Siam is not marked), and the execution and colouring are praiseworthy.

CHART OF NORTH POLAR REGIONS

COMPILED FROM LATEST SOURCES, INCLUDING DR. NANSEN'S DATA

BY J. G. BARTHOLOMEW

The Edinburgh Geographical existed
John Bartholomew & Co.

MAP OF TARAWERA DISTRICT IN SEPTEMBER 1895.

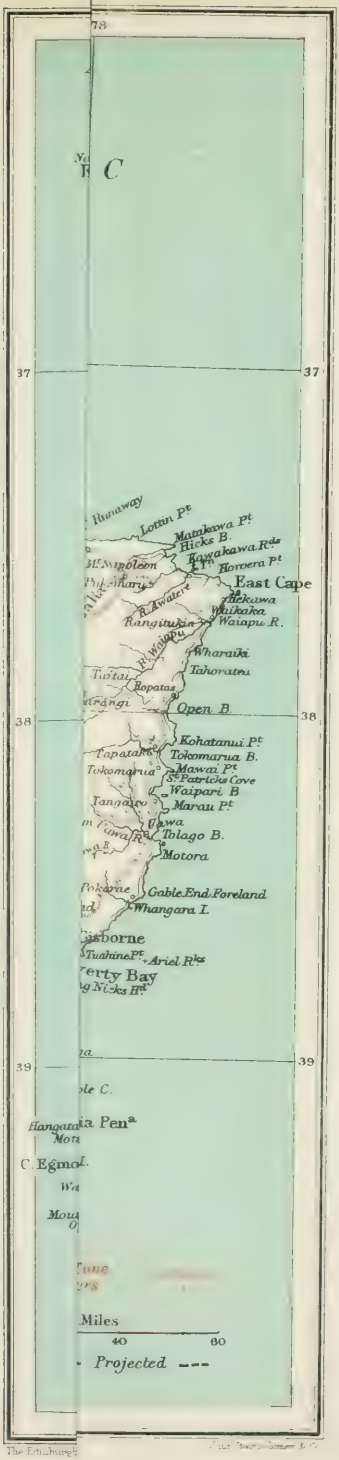
SHOWING THE NEW LAKE ROTOMAHANA AND LINE OF THE GREAT FISSURE

The lakes and other features as they existed previous to the eruptions are indicated in red

The Edinburgh Geographical Institute

Scottish Geographical Magazine 1897

John Bartholomew & Co.


178
C
37
37
Runaway
Lottin Pt
Matakawa Pt
Hicks B.
Kawakawa Rks
Mt Napoleon
Horuera Pt
East Cape
Mt Hikurangi
Te Kawa
Waikaka
Waiapu R.
Rangitukia
Wharaiki
Tokoratu
Tuatai
Ropatas
Open B.
38
38
Kohatanui Pt
Tokomaru B.
Tapatahi
Tokomaruia
Mawai Pt
St Patricks Cove
Waipare B
Tangatea
Marau Pt
Uawa
Tolago B.
Motora
Pokarae
Gable End Foreland
Whangara I.
Tuahine Pt
Ariel Rks
39
39
Hangaroa Pen.
C. Egmont
Miles
40
80
Projected

MAP SHOWING THE VOLCANIC ZONE OF NORTH ISLAND, N.Z.

PACIFIC
OCEAN
Bay of Plenty
Hauraki Gulf
Kaipara Har
Gr^t Barrier I.
Mayor I
White I
Whale I
Mercury B
Slipper I
Whangamarino R
Waiuku
Waiuku R
Manukau Harbour
Waitakere
Kaipara R
Kawhia Har
Aotea Har
Albatross Pt
Gannet I
Whangarei
Mangonui
Kaitaia
Hokianga
Whangaroa
Mt Camel
Mt Eureka
Mt Lofty
Mt Pirongia
Mt Karioi
Mt Maungatautari
Mt Ngongotaha
Mt Tarawera
Mt Edgecumbe
Mt Egmont
Mt Ruapehu
Mt Tongariro
Mt Ngauruhoe
Mt Hikurangi
Mt Pukeamaru
Mt Maunganui
Mt Manuoha
Mt Wharepapa
Mt Te Aroha
Mt Moehau
Mt Pirongia
Mt Karioi
Mt Maungatautari
Mt Ngongotaha
Mt Tarawera
Mt Edgecumbe
Mt Egmont
Mt Ruapehu
Mt Tongariro
Mt Ngauruhoe
Mt Hikurangi
Mt Pukeamaru
Mt Maunganui
Mt Manuoha
Mt Wharepapa
Mt Te Aroha
Mt Moehau
Auckland
Newcastle
Cambridge
Alexandra
Te Awamutu
Kihikihi
Otorohanga
Waitomo
Te Kuiti
Taumarunui
Raglan
Kawhia
Aotea
Albatross Pt
Gannet I
Whangarei
Mangonui
Kaitaia
Hokianga
Whangaroa
Mt Camel
Mt Eureka
Mt Lofty
Mt Pirongia
Mt Karioi
Mt Maungatautari
Mt Ngongotaha
Mt Tarawera
Mt Edgecumbe
Mt Egmont
Mt Ruapehu
Mt Tongariro
Mt Ngauruhoe
Mt Hikurangi
Mt Pukeamaru
Mt Maunganui
Mt Manuoha
Mt Wharepapa
Mt Te Aroha
Mt Moehau
Tauranga
Te Puke
Whakatane
Opotiki
Gisborne
Poverty Bay
East Cape
Open B
Mahia Pen^a
Portland I
Napier
Hawke Bay
Hastings
Waipawa
Waipukurau
Dannevirke
Woodville
Pahiatua
Masterton
Featherston
Greytown
Carterton
Fraserburgh
Wairarapa L
Lake Taupo
Lake Rotorua
Lake Rotoiti
Lake Tarawera
Lake Waikaremoana
Lake Waikare
Lake Waiau
Lake Waiau
Lake Waiau

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THE GEOGRAPHICAL DISTRIBUTION OF FOREST TREES IN CANADA.

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(Read before the Society at Edinburgh and Glasgow, in March.)

(With a Map.)

Introduction.

The writer has studied the geographical distribution of the forest trees of Canada for the last forty years, and during all that time he has had exceptional opportunities for observation, having been engaged each year in exploring, in connection with the Government Geological Survey, one part or another of the region represented on the accompanying map; and, in addition to this extensive personal observation, he has collected much information on the subject from a great number of other travellers. The result has been to ascertain, with considerable accuracy, the limits of distribution of all our native trees from the Atlantic Ocean as far west as the prairie regions.

Tree-Line Map.

In 1873 he prepared a large map showing the northern limits of the principal trees in the four original provinces of the Dominion, and a reduction of this sheet was published in the report of the Montreal Horticultural Society and Fruit Growers' Association for 1879. The timber-tree map accompanying his official report for 1880, published by the Geological Survey in 1882, gives the general northern limits of thirty of our principal forest trees east of the Rocky mountains. The thirty species whose boundaries are shown with greater accuracy on the map accompanying the present paper embrace most of the same trees; but a few substitutions have been made in order to introduce other species of more general interest without increasing the total number

represented, which is as large as can be exhibited with clearness on the scale of 80 miles to 1 inch.

The same signs or forms of conventional lines have been retained for the several species in all the maps, and they have also been adopted where similar work has been done in adjacent parts of the United States. Our present map covers the most important and interesting portion of the great forest region of Canada. Beyond this area the northern species extend to Alaska, and there are valuable forests west of the prairies, in the Rocky mountains and British Columbia. But the northern group embraces only nine species, and the contours of their limits are not known to possess any peculiarities which cannot be described without a map. On the plains, trees of any kind occur only in favoured situations, and the different species are scattered in such a way that it would be difficult to represent the boundaries of their distribution on a map, while in British Columbia most of the trees are of different species from those east of the Rocky mountains, and they would require to be shown on a separate sheet.

In Labrador.

The map of the Labrador peninsula, published in the *Scottish Geographical Magazine* for July 1895, gives the limits of each of the forest trees in that region so far as they are known up to the present time, but owing to the comparatively small amount of exploration which has yet been done in that peninsula, these tree-lines cannot be expected to be so accurate in detail as those of the rest of our map. The official reports of explorations made for the Geological Survey by the writer have generally contained notes on the forest trees of each region, and these have been utilised in preparing the present map. The writer is also indebted for various facts to nearly all his colleagues on the Geological Survey who are engaged in exploring work, and more especially to Messrs. Tyrrell, Low, and Macoun.

Forest Wealth of North America.

North America possesses a forest wealth which is perhaps unequalled in any other region on the globe. No fewer than 340 species of trees are known to be indigenous to the United States. Of these, 123 grow in Canada, 94 occurring east of the Rocky mountains, and the remaining 29 on the Pacific slope. Sixty-four of those east of the mountains are therefore unrepresented on the map, but the greater number of them are confined to small areas in southern Ontario, while those which extend beyond this district are apparently of less interest with regard to their distribution than the thirty species which have been selected for presentation.

Accuracy of the Tree-Lines.

The contours of the limiting lines of each species have been carefully laid down from every source of information up to the present year, and, except in the Labrador peninsula, they cannot be far from the truth. If

there be any defect, it may be the omission of small outliers, patches, or colonies beyond the general boundary of a species, or of small inliers in the form of blank spaces within such boundary in which no trees of the species may occur; but it is probable that if areas such as the former do exist they are of no great extent, while the occurrence of the latter will not alter the general boundaries. As a rule, we may assume that if we select any particular spot on the map we shall find near at hand specimens of all the trees whose limits lie to the northward of it.

Former Erroneous Conceptions.

In the southern portions of Quebec and Ontario, which were the first to be colonised by Europeans, it was observed that the tree-lines ran nearly east and west, and, before the subject had been investigated, it was supposed that the northern limits of the trees of Canada in general ran nearly in this direction; but, as the present map shows, there are great divergencies in the contours of the limit-lines of many species, proving that these contours are governed by other causes than mere latitude.

Only one out of the 340 species of trees above referred to is almost entirely confined to Canada, namely, the widely dispersed Banksian pine, whose southern boundary only touches the south shore of Lake Superior and takes in a small part of the State of Minnesota.

Canada as a Whole.

In the descriptions to follow, the geographical distribution of our forest trees is treated without reference to provincial boundaries, the introduction of which would only complicate matters and serve no good purpose.

Region of Luxuriant Mixed Forest.

In Canada and the United States the forests are more commonly called "woods" and "bush." The finest forests of North America, both as to variety of species and luxuriance of growth, were those of the middle and northern states, of which Ohio is about the centre. These splendid woods, which have been largely destroyed in the progress of the settlement of the country, extend into Pennsylvania, Kentucky, Tennessee, Indiana, Michigan, and southern Ontario. On any uncleared farm lot in the last-named region, one might find fifty or more kinds of native trees, all mingled together. This is in marked contrast to the poverty in species of the indigenous forests of the British Islands, where only about a dozen are represented, or indeed to the small number occurring in the forests of Europe in general.

Botanic Limits of Trees.

The tree-lines on the map represent the limits of each species from a botanic rather than an economic point of view; for in some parts of its range the trees of any species may be so small or scattered as to have no commercial value. But as the public know so little as yet about such

matters, these lines may be of considerable importance in connection with questions affecting the future supplies of our various kinds of timber. Not so many years ago a vague impression prevailed in Canada that there was scarcely any limit to the northward and westward range of the white pine, which afforded our staple export timber. The author's tree-map, published in 1879, first dispelled this illusion, and caused some alarm among those interested in our forest wealth. One of the causes of this erroneous impression was the frequent allusions by travellers and the Hudson Bay Company's men, who came from Britain, to "pine" in the northern regions. To Canadians the word "pine," without any qualification, always means the white pine (*Pinus strobus*), and it appears to have been taken for granted that the persons just referred to used it in the same sense, whereas they referred to the spruce or balsam fir.

Gradual and Abrupt Termination of Trees.

In approaching their northern limits, some kinds of trees become gradually smaller and smaller, and are finally reduced to mere bushes before they disappear altogether, while others terminate abruptly or without any apparent diminution in the average size of the individual trunks. The latter habit is commoner in the southern than in the northern species, and it appears to prevail more in the eastern than in the western parts of Canada. As examples of this we may cite the black walnut, the chestnut, buttonwood, elm, yellow birch, basswood, hemlock, white and red pine, and white cedar.

It is probable that those trees which bear large numbers of seeds, capable of being carried for some distance by the wind, such as the conifers and the poplars, have now reached the extreme northern limits of their growth; but some other species may be continuing to extend their borders. Indeed the general tendency appears to be to advance still farther north, as if many kinds of our trees had not yet had sufficient time to occupy all the territory congenial to their existence. In support of this view it may be mentioned that the few experiments that have been made in artificially transferring the more southern species northward have been successful through long distances. Among these experiments one of the most important is that of the Hon. Sir Henri Joly de Lotbinière, who has found that the black walnut grows well and forms wood rapidly near the city of Quebec, although the nearest place in Canada where it is found growing naturally is in the Niagara district, about 500 miles to the south-west. At Carleton Place, thirty-five miles south-west of Ottawa City, and 200 miles from the Niagara district, the late Mr. Robert Bell raised black walnut-trees, which are now producing ripe nuts. These facts prove that the range of this, our most valuable timber, is capable of being extended over a much greater area than it yet occupies naturally. Pelee Island, in Lake Erie, is the most southern portion of Canada, and this is the only locality in the country where the honey-locust and the Kentucky coffee-tree are known to grow naturally; but the former flourishes well

wherever it has been planted, throughout the lake peninsula of Ontario, and down the St. Lawrence nearly to Montreal, and small trees of it are also doing well at Ottawa. The Kentucky coffee-tree has also been found to grow to maturity at Ottawa. The negundo, or Manitoba maple, has not extended its range east of the western part of Lake Superior, and yet it is found to grow as well all the way to Montreal, 900 miles to the east of this, as it does in Manitoba. It is also successfully cultivated at Lac la Biche, far to the north-west of its natural habitat. The black ash proves quite hardy when transported to Moose Factory on James Bay, more than 100 miles northward of its present range, and where it is exposed to the chilling influence of the sea air. There is little doubt that other kinds of trees, if tried, would be found to flourish beyond their present range. This ability of various native trees to grow far from their existing limits is probably not attributable to an improvement in the climate since they attained their present range, for there is no meteorological proof of such improvement, and, on the contrary, there is evidence that the verge of the forest is retreating southward both in North America and Asia. It is more likely due to the cause above suggested, namely, that sufficient time has not yet elapsed to have permitted the fullest possible territorial expansion of all the species.

When frost alone operates to check the northward extension of a tree, there would appear to be no reason why such a species should not grow as far in that direction as it can ripen its seeds, even once in a number of years. When early frost happened to coincide with good seed years, many seasons might intervene between crops of ripe seeds, and the natural progress of northward extension would be very slow. The red oak, which requires two seasons to ripen its fruit, would suffer a double disadvantage. The writer has noticed that beech, elm, and black ash-trees, when growing in the most northern situations, seldom bear any fruit.

As a rule, each species is at its best in the central part of the area it occupies, both as to breadth and longitudinal extension. Following this rule in cases where the northern limits of certain species only come a short distance into Canada, the finest specimens of these will be found to the southward, in the United States.

Some Features of the Tree-Lines.

One of the most striking characteristics of the tree-limits, as shown on the accompanying map, is the approximate parallelism of many of them to the general trend of the various sea-coasts, including those of Hudson Bay. There is, therefore, obviously some connection of the one circumstance with the other, and this connection becomes still more apparent when we also take into consideration the lines of former sea-coasts which must have existed when the land was at lower levels. A study of certain tree-lines shows that their present contours are in some way connected with conditions which existed in late geological times, and that any explanation of them must be involved with questions of

Pleistocene geology, such as the elevation and partial subsidence of the continent, with consequent changes in the ocean currents and in the temperatures of both sea and land; also with the shifting of glacial centres, followed by the presence or absence of ice in certain regions at different times. The distribution of the Banksian pine and the balsam poplar will serve to illustrate the above inference. The former seems to shun proximity to the sea, while the latter seeks it. If we trace the boundary of the Banksian pine throughout its whole course, we shall observe that it nowhere touches the salt water, while the balsam poplar is found everywhere near to the sea as far north as it can grow, but it is apparently wanting over a great area in the central part of Labrador, which is probably too far inland for it to flourish. The southern lobe of this vacant space extends into the Ottawa valley in precisely the same south-westerly direction that was followed by the land ice from the old centre of glaciation in central Labrador to this valley. The erratic course of the balsam poplar line north-west of Hudson Bay may be connected with changes which took place in the later movements of the glacier ice in that region.

Continuation of Pleistocene Conditions.

Around the shores of James Bay the land is only moderately elevated for a considerable distance inland, especially on the west side, where a level tract extends for more than 100 miles from the sea. This border of low land affords abundant evidence of having been submerged in post-Pliocene times, and the line of the Banksian pine still skirts its margin all the way round, not having had time as yet to invade the old sea-bottom to any appreciable extent. It will be observed that the southern boundary of the Banksian pine reaches its extreme limit between the lower part of the Ottawa river and Georgian Bay of Lake Huron, where it intersects the 45th parallel. In explanation of this decided southward curve, we find unusually high ground to the north-west of Ottawa and throughout much of the tract between this city and Georgian Bay, which would stand out as a promontory when the sea covered the country to the south and east, as it is known to have done at about the same time as it submerged the district around the head of James Bay. An outlier of the Banksian pine occurs in New Brunswick, and another in Nova Scotia, both being at some distance from the open sea.

Peculiarities of the White Cedar Line.

The boundary of the white cedar is perhaps the most remarkable tree-line upon the map. In the central part its course is tolerably direct, but in both the east and west it turns southward and crosses the other tree-lines at right angles. If it had followed the average course of the boundaries of the other trees with which it is associated, it would have included the island of Anticosti, the whole of the maritime provinces, and the greater part of Newfoundland, in all of which the conditions of climate, soil, etc., are evidently as favourable for the growth of this tree as they are in New Brunswick and the Gaspé peninsula, where it is quite

abundant, and even larger and finer than usual. The most probable explanation of this singular feature is to suppose that when the tree had established itself in the latter regions, Nova Scotia was an island, and that the seeds of the cedar had no good means of crossing a considerable breadth of water. There is evidence that a strait did separate Nova Scotia from New Brunswick where the cedar line passes, but since it became dry land the tree has made little progress towards occupying the peninsula. The white cedar occurs in the western part of Prince Edward Island, and in the form of a few clumps on the eastern side of the Bay of Fundy.

If these occurrences are due to seeds having floated thither, this fact would show that they are not killed by immersion in salt water, and that no seeds have yet floated to the more distant shores of the cedarless regions above mentioned, or that, if some have chanced to do so, they did not reach suitable ground in which to grow. The cones of the cedar open and shed their seeds before they themselves fall off the trees, and it is possible that the naked seeds, on being blown into the sea, become water-logged and sink. It could then only be by a rare accident that seeds capable of germinating would be carried across any considerable breadth of sea water. When stranded upon a distant beach, they would have little chance of being carried from it to a suitable soil for their propagation, as, owing to their unpleasant taste and odour, they have no attraction for any bird or beast. These suggestions are made in order to show that there may be some simple reason for the absence of the cedar from the greater part of the lands surrounding the Gulf of St. Lawrence. The currents in the Gulf, and the strong tide which must have passed through the strait formerly separating Nova Scotia from New Brunswick, may have prevented the seeds of the cedar crossing to those parts from which the tree is absent; but if this were so, it becomes difficult to understand why the white pine, yellow birch, and other trees which are more southern in their general habit than the species in question, should be found in the cedarless areas. If some one were to plant the white cedar in Anticosti, Newfoundland, Cape Breton, and the eastern parts of Nova Scotia and Prince Edward Island, the experiment would be of much interest; and the writer ventures to predict that the trees would do well.

To the west of James Bay the white cedar attains a higher latitude than anywhere else, owing probably to the occurrence there of limestone rocks which afford suitable conditions for its growth. From this latitude it drops suddenly to the south of English river, and then turns westward to the head of Lake Winnipeg—in both cases running directly across the other tree-lines—and from the latter point it continues south into the United States, keeping on the east side of the Red river valley. The pronounced bend to the south side of English river may have some significance in connection with the last phase of glacial action in this region.

A remarkable outlier of small white cedars occurs around Cedar lake on the Saskatchewan river near its mouth, and at a distance of nearly 290 miles northward from the nearest point on the main boundary of the

species at the south end of Lake Winnipeg. The existence of the white cedar at this particular locality, so far removed from its general limits, may have been rendered possible by a combination of conditions such as the required soil, moisture, warmth, etc., which may not be all united at any intermediate locality: or perhaps some better explanation may be found to account for this singular outlier.

Perhaps it is due to human agency, as the Indians often carry cedar boughs in the bottoms of their canoes as a lining, for which purpose they are very suitable on account of their flatness. It is probable that if care were taken to plant the cedar in suitable situations, it would be found to grow at almost any other locality on the western side of Lake Winnipeg, for it appears probable that this and some other species of our trees have not yet reached in all quarters the limits of their possible extension from the southward; in other words, it is not by any means certain that the present limits of all our trees have become permanently established. Some of them may be still slowly progressing from the southward in one part, and possibly retreating in another, or some may be advancing or retiring all along the line.

The slow rate at which most kinds of trees have spread themselves over the country is evidence, either that more than 10,000 or 20,000 years have elapsed since the glaciers retired from their most southern extension to the Arctic regions, or that they were never confluent across the greater part of the intervening country.

Means for the Diffusion of Trees.

The seeds of some kinds of trees are endowed with much better means of transportation than others, as, for example, the down of the poplar seeds and the wings of those of the conifers, and hence such species may have reached the utmost limits of their possible growth. Some species are prolific in individual trees, while others are nowhere common, being only sparingly scattered in all parts of their area of distribution, and as they produce proportionately less seed, they will make slower progress in occupying new ground. With some species "seed years" occur seldomer than with others, and this is another cause of disparity in the rate of dispersion of different species. The number of seeds produced by some of the nut-bearing trees is extremely small compared with that of most others, and no provision is made for scattering the nuts by the wind. But other means are not wanting, and one of the most interesting is that of the squirrels and the birds of prey. It is a common thing for a squirrel, when running off with a nut to a distance from the parent tree, to be attacked by a hawk, when he will immediately drop his burden to facilitate his escape, and this nut may have an opportunity to germinate the following spring. Again, if he should fall a prey to the bird, all the "caches" of nuts which he has made in the ground may grow the next year.

Outliers or Colonies.

The following may be mentioned as examples of the known outliers or

BANKSIAN PINE (*Pinus Banksiana*).
(*N.B.—The central tree only.*)

WHITE PINE (*Pinus strobus*).
OLD TREES AND SECOND GROWTH.

RED PINE.
(*Pinus resinosa.*)

Photographed by Inv. R. B.W.

SUGAR MAPLE.
(*Acer saccharinum.*)

WHITE ELM.
(*Ulmus Americana.*)

BASSWOOD OR LINDEN.
(*Tilia Americana.*)

Photographed by Dr. R. Bell.]

colonies of trees entirely separated from the main areas occupied by the various species:—

1. *Banksian Pine.*—One in Nova Scotia, and another in New Brunswick.

2. *White Pine.*—Several isolated patches near the northern limit of this tree beyond the Upper Ottawa river, and others north of Lake Superior.

3. *Red Pine.*—One on Big Black Island in Lake Winnipeg, discovered by Mr. Tyrrell. Many of the groves on the head-waters of the Abittibi river lie at some distance from one another, but all these are included within the general northern limit. Sir John Richardson mentions an outlier of this species at Lac la Loche on the upper waters of the Churchill river, but subsequent observation has shown it to be a grove of Banksian pines.

4. *White Cedar.*—The outliers on the east side of the Bay of Fundy and on the west end of Prince Edward Island have been already referred to, as well as the remarkable one of Cedar Lake at the mouth of the Saskatchewan. Along the general boundary of this tree isolated groves occur in favourable situations, such as on limestone rocks and around the shores of lakes, where the warm season is prolonged by the slow escape of the heat which has been stored up in the water.

5. *Hemlock Spruce.*—A colony is said to exist near Thompson, in Minnesota, a short distance west of the head of Lake Superior; but the tree does not occur on the Kaministiquia river, Thunder Bay, as supposed by Sir John Richardson.

6. *Balsam Poplar.*—Several small patches occur on the headwaters of the Bell river, within the great area from which it is otherwise absent.

7. *Basswood.*—There is an outlier of this tree at Lake St. John, north of Quebec, and nearly one hundred miles beyond the general limit of the species.

8. *Beech.*—A small colony of this species occurs about two miles north of the town of Massey on Spanish river; but it is only a few miles outside of the main boundary. The beech does not occur on the Red river of the North, as erroneously mentioned by Sir John Richardson, nor in the treeless region of Back's Great Fish river, as inaccurately stated by Dr. Sutherland.

9. *Buttonwood.*—A number of these trees were growing a few years ago along the Sageen river in the county of Bruce, far outside of the main boundary.

The occurrence of outliers of so many species tends to disprove the theory that these phenomena are evidences of the dying out of a species on account of the antiquity of its origin. They are rather to be regarded as the precursors of the advance of the boundaries of the several species, the general tendency being towards enlargement.

Vacant Spaces.

Blanks, or spaces within the general area of distribution of any tree in which no specimen of it can be found, are more liable to be overlooked

than are outliers of any species, since the latter attract the attention of observers so much more easily. Mention has already been made of the immense inlying blank of the balsam poplar, which stretches from the interior of Labrador to the Ottawa valley. There is a large area between James Bay and Lake Superior from which both the elm and black ash are absent, although this space is within the general range of both these species. This blank is probably owing to the greater elevation of the area, which in this latitude must have a considerable effect on the climate, rendering it less favourable than that of the belt of lower ground to the northward in which these two species are still sparingly scattered. The balsam fir is wanting in some tracts on the upper branches of the Albany river, in which it might be expected to be found.

It is believed that closer investigation may prove the existence of many vacant spaces within the general limits of various species, in which none of their representatives can be found, besides such areas as swamps, sand plains, etc., which are manifestly unsuited to their growth.

Conditions Governing Distribution.

In the part of Canada under consideration, the presence or absence of different trees, or the contours of the lines bounding their geographical distribution, are determined by general climatic conditions, modified to a greater or less degree by the following circumstances, which will be briefly considered:—

1. Distance or proximity of the sea, or of the areas which were covered by it in recent geological times.
2. Changes which have taken place in the arrangement of land and water while the trees were spreading over the continent.
3. General dryness or moisture of the climate affecting considerable areas.
4. Extremes of heat and cold.
5. Local heat and moisture from lakes and rivers.
6. General elevation above the sea.
7. Local elevations (with consequent dryness) over level, wet, or cold lands.
8. Large local depressions.
9. Diseases and insect pests.
10. Rapid or slow natural means of dispersion.

1. The opposite effects of the sea on the distribution of the Banksian pine and the balsam poplar have been already described. In the Labrador peninsula the tree-lines bend southward in approaching the coast on either side, showing that the sea has an unfavourable influence. The blighting effect of the cold Atlantic especially is very marked, as it prevents the growth of almost all timber on the coast-line, except the most hardy kinds in the southern part. The tree-lines run almost parallel to the ocean, the tenderer species being found farther and farther inland. Some kinds of trees are found in the western part of Newfoundland which do not cross to the east side of the island in the

same latitudes. In New Brunswick and Nova Scotia the tree-lines all curve southward, as if to avoid the influence of the cold water of the Gulf of St. Lawrence.

2. The effect of a different arrangement of land and water at a late geological period is seen principally in the absence of the white cedar from Nova Scotia, and its distance inland on the west side of James Bay. The course of the Banksian pine line round James Bay and north of the St. Lawrence has been caused by a former extension of the sea.

3. The greater dryness of the region between Red river and the Rocky mountains is one of the principal causes of its treeless and partially treeless condition. The former country is called plain, and the latter prairie. The other principal cause is the extremes of heat and cold. Some persons have jumped to the conclusion that the plains and prairies have resulted from repeated fires burning off pre-existing forests in modern times. If this were the case, the tree-lines in their general westward course would all end abruptly at the edge of the burnt space, and some traces of the various species would still be found in the prairie region. But, instead of this, on approaching the prairie country they all curve gradually to the southward in a concentric fashion, so that what was the northern limit of each successive species now becomes in turn its western boundary. Some species reach the Red river valley before they bend south, while others begin their curve at greater and greater distances off. Those affected in this way are the white cedar, black ash, white ash, white pine, red pine, sugar maple, red or soft maple, yellow birch, red oak, hemlock, ironwood, beech, and red cedar. Towards the prairie region these are replaced to some extent by western trees, such as the negundo or Manitoba maple, the green ash, and the cottonwood, which is another indication of climatic change in this region. Such well-marked features of long-established forest distribution are sufficient to prove that the present divisions of prairie and woodland are of ancient date, and not due to the destruction of timber corresponding with the extent of the open country. But if other evidence be required, it may be found in the prairie flora, the absence of hollows, with hillocks accompanying them, left by the bodily upturning of the roots of trees with a large quantity of earth attached, which are always to be found where forests have grown; the comparative scarcity of water-courses, and the prevalence of regular rings of boulders around the edges of the nearly circular ponds which have resulted from the action of ice in a treeless region.

4. Extremes of heat and cold have also contributed to prevent the growth of the above-mentioned trees in the plain and prairie country.

We have already seen that some of our most southern trees may be successfully transplanted far beyond their present natural range; but the experiments which have been made in the plain and prairie regions seem to show that there only the hardiest trees will flourish at all. If the various species of the forest region lying to the eastward of the prairie region had recently flourished in the now open country, we should expect to find that they would grow again when planted there; but such is not the case.

5. Local heat and moisture derived from lakes and rivers are beneficial to the growth of our northern trees, and in many localities they even determine the presence of some species. The white spruce, balsam poplar, etc. attain a greater size on the islands and along the banks of the large rivers flowing northward than at a distance from their influence. Along the North Saskatchewan, which flows through a dry region, the negundo, green ash, grey elm, white birch, and black alder grow only on the banks of the river. Everywhere in the white cedar region, as we approach its northern limit, these trees are confined to a border along the rivers and around the lakes. The most northerly outposts of the black ash occur at rapids in north-flowing streams, where the overhanging trees can enjoy the heat escaping from the water. In such advanced situations the tender leaves and shoots are apt to be nipped by the late spring frosts. Fruit is grown with more success on the southern sides of the larger lakes than elsewhere, as the air which moves from the northward off the water prevents the occurrence of summer frosts.

6. The effect of general elevation above the sea is well illustrated in the large area between James Bay and Lake Superior, in which no elm or black ash occur, whereas these trees grow to a good size on the Albany and the branches of Moose river to the northward.

7. Local elevation, and consequent dryness and warmth, as compared with adjacent low and cold lands, account for the growth of such trees as the sugar maple, ironwood, basswood, hemlock, etc. in many places north of the Ottawa and elsewhere at considerable distances beyond their last appearances in the river valleys. For the same reason, thrifty forests of yellow birch cover the hills in large districts north of Lake Huron.

8. Local depressions have a favourable influence in carrying the tree-lines northward. Lake Temiscaming, at the great bend of the Ottawa, lies in a north and south valley several hundred feet below the level of the surrounding plateau, and here the white oak grows fully fifty miles beyond its general range, while the limits of several other species protrude some distance up the valley. Lake St. John, about 150 miles north of Quebec, is only slightly elevated above the sea-level, and the forest around it has a more southern character than that of the neighbouring high lands; but this may be partly due to the occurrence of nearly horizontal Silurian rocks. The basswood grows here apparently as an outlier, and the lines of the red oak, sugar maple, yellow birch, and red pine curve northward so as to include the lake.

9. Diseases and insect pests have occasionally some effect on forest growth in Canada. A few years ago most of the spruce-trees over a large tract in New Brunswick and the Gaspé peninsula died of a disease which was accompanied by a white fungus upon the roots. About the year 1889 an imported saw-fly commenced to attack the larches in the region to the south-east of James Bay, and, being in a new country without natural enemies, it spread with wonderful rapidity. By the year 1895 it had killed most of the larch-trees all the way from Rupert's House to within 100 miles of Ottawa city, and from these points to the centre of the Labrador peninsula, a distance of some 500 miles each way.

Tree-Lines in Minnesota.

The State of Minnesota is situated in a very interesting region in regard to forest distribution. Here we find the northern limit of the group of trees to which the most southern species of Ontario belong, such as the black walnut, buttonwood, shell-bark hickory, hackberry, and Kentucky coffee-tree; the north-western limit of the commoner trees of the northern States and of Quebec and Ontario, such as the white oak, red cedar, iron-wood, white ash, rock elm, red oak, yellow birch, sugar maple, red maple, etc.; the western boundaries of some of the trees whose northern limits pass through northern Ontario, such as the white cedar, black ash, white pine, and red pine; the southern limits of the most northern group, including the white and black spruce, the larch, Banksian pine, balsam fir, balsam poplar, and canoe birch; and the general eastern limits of some of the western species, such as the negundo or Manitoba maple, the green ash, and the cottonwood. The boundaries of the trees of Minnesota have been mapped out by Professor N. H. Winchell, State geologist.

The Great Northern Forest.

Reference has already been made to the great northern forest of Canada, which stretches from the Strait of Belle Isle round by the southern end of James Bay to Alaska, a distance of about 4000 miles, with a breadth of some 700 miles. This vast forest has everywhere the same characteristic features. The trees, as a rule, are not large, and they consist essentially of the following nine species:—black spruce, white spruce, Banksian pine, larch, balsam fir, aspen, balsam poplar, canoe birch, and bird cherry, with several kinds of small willows, which, however, seldom attain the size of trees. White cedar, white and red pine, black ash, and rowan occur sparingly in the southern part of this belt.

Fires and Second Growth.

As a rule, any extensive view over this vast region presents a "patchy" appearance, owing to the different shades of green covering larger or smaller areas. These various shades indicate growths of different ages, which commenced after forest fires at different periods; but ultimately the trees all go through the same stages, and arrive at maturity in the same number of years. These patches may be of limited extent, or they may embrace many thousands of square miles, but a uniform process is going on in each of them. It begins with the complete destruction by fire of the preëxisting growth of trees, and ends with a burning of the newly matured forest similar to that which preceded it.

Forest Fires are Natural Phenomena.

These fires are natural phenomena, being mostly due to lightning in the summer-time, and they have no doubt been going on from time immemorial. Lightning is of frequent occurrence during the hot, dry season

in all parts of Canada. At this time of the year we read in the newspapers of numerous buildings being set on fire every week from this cause, and we should naturally expect many fires to originate in the same way in the forests, and there is ample proof that they do originate in this manner, especially in these northern woods. The writer has been an eye-witness to the fact, and most persons who have travelled much in these regions have seen the same thing happen. A description of one of these great fires in our northern forest-belt forms a part of their natural history, being the concluding event from which the growth starts afresh.

Fires in the Northern Forest.

Let us imagine ourselves in an old forest of this region, of practically unlimited extent, and consisting of a dense growth of black and white spruce, Banksian pine, tamarack, and balsam fir. The smaller trees fill up the spaces between the larger ones, and all are crowded so closely together that their branches touch or intermingle with each other. In this way a sufficiently dense mass of fuel is formed to support a continuous sheet of flame on a grand scale, and yet it is sufficiently open to furnish a plentiful supply of air to carry on the conflagration. The ground is deeply covered with moss, and an accumulation of fallen trees and branches is lying about in all directions. After the prolonged hot weather and drought of the summer months the moisture has become thoroughly dried out of the gummy boughs of the standing trees, leaving their great store of resin and turpentine, as well as the wood itself, all ready for burning. The mossy carpet and the fallen timber are alike dry. All the conditions are now ready, and only await a spark of fire to start one of the wildest and grandest scenes of destruction which can take place on the face of the earth.

When the fire has got under way the pitchy trees burn with almost explosive rapidity. The flames rush through their branches and high above their tops with a terrifying sound. The ascending heat soon develops a strong breeze, if a wind does not happen to be blowing already. Before this gale the fire sweeps on with a roaring noise as fast as a horse can gallop. The irresistible front of flame devours the forest before it as rapidly as a prairie fire licks up the dry grass. The line of the gigantic conflagration has a height of 100 feet or more above the tree-tops, or 200 feet from the ground. Great sheets of flame disconnect themselves from the fiery avalanche and leap upward as towering tongues of fire, or dart forward, bridging over wide spaces, such as lakes and rivers, and starting the fire afresh in advance of the main column, as if impatient of the slower progress it is making. These immense shooting flames are probably due to the large quantities of highly inflammable gas evolved by the heat from the pitchy tree-tops just in advance of actual combustion, and they help to account for the incredible speed of most of the larger forest fires.

One of them, which occurred in the Saguenay region, and of which we have exact particulars, was known to run over 150 miles in ten hours, or at the rate of fifteen miles an hour. Thus in a single day the appear-

ance which a large tract of country is to wear for the next hundred years or more is completely changed. Even greater tracts of country than this have been known to be burnt up at a single conflagration. One of these fires, which started west of Lake Superior and swept round its north side about 1845, was ascertained to have travelled about 300 miles in less than a week. A few years later another fire extended from the country north of Lake Huron into the Ottawa valley, a distance of some 200 miles, in the space of a few days. Three or four years ago, forest fires, hundreds of miles long, swept through Michigan, Wisconsin, and Minnesota, destroying several hundreds of human lives, and millions of dollars' worth of timber. Some of the great fires of the almost boundless forests farther north seem to have been even more extensive, from all that we can learn from the natives in regard to them.

The wild animals appear to understand the significance of the roaring noise and the clouds of smoke in the sky in advance of these conflagrations. The terrified deer, bears, wolves, foxes, lynxes, and hares flee for their lives, followed by multitudes of the small fur-bearing animals; but as a rule all are soon overtaken and destroyed. Should any of the larger beasts be fortunate enough to reach a lake or river in time, they may escape along with the beavers, muskrats, otters, and minks, which seldom stray far from the water. The birds fly up into the air in confusion in advance of the wall of fire, and appear to become stifled by the heat and smoke, and after fluttering about for a few minutes they fall into the flames and perish.

These great fires come to an end in different ways. It may be by a change in the wind, followed by a deluge of rain, or by coming to a wide extent of previously burnt country, or of small deciduous trees, or to a chain of large lakes.

Evolution of the New Forests.

The dead trunks of the larger trees generally stand for many years after the fire. In the summer following one of these conflagrations, the blackened ground becomes partly covered by a growth of herbaceous plants, berry bushes, and shoots from the roots and butts of deciduous trees which have retained some vitality, besides numerous small seedling trees. The huckleberry bushes, which are very common for the first few years, especially on rocky, siliceous ground, bear abundant crops of fruit. They have sprung from large old roots which are almost everywhere present in the thick woods, although their tops are quite inconspicuous, and bear few or no berries. In fifteen or twenty years the ground is covered with poplars, birches, willows, etc., to a height of about thirty feet. By this time the dead trunks of the old *brulé* have lost most of their branches, and the smaller ones have fallen down. If we look under this growth, we shall discover many healthy young conifers overshadowed by the more rapidly growing deciduous trees. At the end of about fifty years the conifers are everywhere showing their heads, in the form of sharp apices, their dark green colour contrasting strongly with the lighter shades of the other trees. In the race to get above the deciduous

growth, they develop tall trunks with the branches high up. In one hundred years the poplars are dying and falling down, and the canoe birch has attained maturity and soon after shows signs of old age. Meantime the older conifers have overtopped the other trees and given a new character to the general appearance of the forest. The younger conifers of various ages, which have been springing up from seed every year, take possession of the ground left by the decay of the first occupants, and in about one hundred and fifty years the forest has again become almost entirely coniferous, and is ready to be destroyed once more by fire. Such is the rotation of crops of trees which is perpetually going on in these regions. Perhaps one-third of the whole area consists of "second growths" of less than fifty years, one-third of trees from fifty to one hundred years old, while the remaining third may be one hundred years and upwards.

The Banksian Pine in relation to Fire.

Fire appears to be a necessity in the propagation of the Banksian pine. Its knotty cones are not deciduous, but stick to the tree as long as it lasts, the older crops becoming covered with lichens and showing great age. If the tree dies or falls over and decays, the cones lie about unopened. But when the standing trees are scorched by a forest fire, the cones immediately open, and the seeds become scattered far and wide by the wind. Forest fires have probably occurred every year since trees of the present species existed on the continent, and an interesting question arises as to how the Banksian pine acquired this curious habit. Charred wood occurs under great depths of Pleistocene deposits near Toronto, while there is no evidence of the advent of man in Canada until a very recent period.

THE MARKET FISHES AND MARINE COMMERCIAL PRODUCTS OF AUSTRALIA.

By W. Saville-Kent, F.L.S., F.Z.S.

(Read before the Society in Edinburgh, on April 22nd.)

Considering that the land area of Australia, estimated at 2,933,000 square miles, is not much less than that of the continent of Europe, and that it extends from the parallel of 10° S. lat., within the Tropics, to that of 43½° S. lat. in the Temperate Zone, its fish fauna and commercial marine products may naturally be expected to exhibit great variety.

Roughly classified, the Australian fishery products consist of half a dozen items of primary importance, and a nearly equal number of secondary value.

To the first-named of these categories may be referred:—(1), The Market Fishes in the ordinary sense of the term; (2), The Oyster fisheries;

(3), The Pearl and Mother-of-Pearl-shell fisheries; (4), The Trepang or Bêche-de-mer fisheries; (5), The *Crustacea*, or Crab and Crayfish industries; (6), The Turtle and Turtle-shell, or so-called Tortoise-shell, fisheries. To the second group may be counted:—(7), The Guano industry; (8), The Dugong fishery; (9), The Ornamental Shell and Coral industry; (10), a potential, but as yet undeveloped, Sponge industry; and (11), a now practically exhausted and abandoned Whale fishery.

A separate lecture might appropriately be devoted to nearly every single one of the above subjects, and therefore it will be impossible to give, in the present address, more than a survey of the more salient features.

The subject that first invites attention is that of the Australian market fishes. With regard to their geographical distribution these fishes form several very distinct groups, which may conveniently be considered in detail.

Tasmania in the extreme south, a separate island colony of approximately the size of Ireland, and lying between the parallels of 40° and 43½° S. lat., possesses a marine fish fauna essentially distinct from that of the Australian seaboard, from which it is separated by Bass's Straits. This most southern fish faunal area may conveniently be designated as the Tasmanian, or that of the South Temperate Zone.

The capitals, and concurrently the head market centres, of the five colonies of the Australian mainland—Queensland, New South Wales, Victoria, South Australia, Western Australia—are, as it happens, all situated within the zone bounded by the parallels of 27° and 38° S. lat., a zone practically coincident in breadth with that occupied by the British Islands, but in a different position. As a result of the approximation of latitude the food fishes supplied to these mainland capitals correspond on the whole very closely to one another, and since Brisbane, the capital of Queensland, is nearer the Equator than Cairo, while the latitudes of Sydney, Adelaide, Perth, and Melbourne correspond roughly to those of Tripoli, Tunis, and Palermo, the fish fauna indigenous to the adjacent coasts may be accurately designated sub-tropical.

To the north of the sub-tropical zone there still remains an area comprising one-third of the entire continent of Australia, and this lies entirely within the Tropics. The fish and other marine products of this area, being of an essentially tropical character, invite separate consideration.

Proceeding to a nearer examination of the three fish faunal groups, we find, as might be anticipated, that the one belonging to the South Temperate, or Tasmanian, zone possesses the greatest number of types having counterparts in British waters. Even here, however, as in all Australian fish-markets, the traveller from Europe will be struck by the absence of the greater number of the most familiar home types, and by the presence of numerous forms that will be new to him. Most conspicuous by its absence will be that very important group generally known in British markets as "flat fishes," belonging to the family of the Pleuronectidæ, and including such familiar forms as the Turbot, the Plaice, the Halibut, and the many varieties of Sole. It is true that a few species

of soles and flounders occur in South Australian waters, but they are for the most part so small, and are relatively so scarce, as to constitute a very insignificant item in the market list.

It is, indeed, this absence of large commercially valuable flat fishes, and other ground-frequenting market fishes, that renders trawl-fishing unprofitable in Australian waters. (By the "trawl" I here mean the bag-net towed by a sailing vessel or steam-trawler along the bottom of the sea. On the Scottish coasts the ordinary seine or trawling-net is, I believe, occasionally denoted by the same name.) The trawl-net has been experimentally fished with by myself and others on the coasts of several of the Australian colonies, but the results, from a commercial standpoint, have been in all cases disappointingly unremunerative.

A second highly important group of commercially valuable fishes that is very sparsely represented in the Australian markets, is the Cod family or Gadidæ. The Cod, the Whiting, the Pollack, the Ling, the Hake, the Coal-fish or Saith, are a few of the more familiar members of this important group that are indigenous to British waters. Many of these, being essentially ground-frequenting species, are to a large extent taken with the trawl-net. It is frequently asserted (notably in Dr. Günther's *Introduction to the Study of Fishes*, p. 284), that the Cod family is apparently totally unrepresented in Australian waters. One species, however, the so-called Rock Cod (*Pseudophycis barbatus*), is a common market fish at Hobart, Tasmania, while an allied form, *Lotella callarias*, is occasionally exposed for sale in Sydney and Melbourne.

Of the Tasmanian fauna the most important edible fish is the celebrated Hobart, or Real Trumpeter (*Latris Hecateia*), which grows to a length of two or three feet, and has been taken weighing 60 or even 70 lbs., though most of those brought to market and the most delicate in flavour weigh 4 to 15 lbs. The boats employed in Trumpeter fishing are usually provided with capacious wells through which the water circulates freely. In these wells the fish are kept alive until brought into port, where they are transferred to floating coffers. Such is the reputation of the Hobart Trumpeters that quantities of them are smoked and sent to Melbourne and Sydney, and not infrequently living fish are shipped to those ports in large well-boats. Two or three other species of Trumpeter, referable to the same genus *Latris*, are indigenous to, and essentially characteristic of, Tasmanian waters, but they are of smaller size and are less esteemed than the Hobart species.

While the Real Trumpeter, like the Turbot in Great Britain, graces the table of the wealthy, the Barracouta (*Thyrsites atun*) may be styled the poor man's fish, for it takes in Tasmania the place occupied in the British market by the modest herring and the haddock. The fact that a six or eight pound Barracouta of the best quality can generally be bought for fourpence or sixpence places this fish within reach of all classes. Notwithstanding its cheapness, the Barracouta is by no means to be despised. Carefully smoked, after the manner of the familiar Findon haddie, it constitutes a no less toothsome adjunct to the breakfast table. Barracouta pie, again, the invention of a Tasmanian culinary genius, is a savoury dish that would tickle the palate of the most fastidious.

The habits of the Barracouta are decidedly gregarious. Collecting in large numbers, it pursues and preys upon the shoals of smaller fish of every description that swim in the surface waters, and renders fishing by drift-nets, so extensively used in British waters to capture mackerel and other surface fish, impracticable in the Australian seas. The most approved implement for catching the Barracouta on the Tasmanian coast is the Maori jig, so called because it is supposed to have been first employed by the natives of New Zealand. This instrument consists simply of one or two pointed but unbarbed hooks fastened to a small block of wood, which in its turn is attached by a strong line, a yard or two long, to a stout staff. Sometimes a piece of coloured cloth or of shark's skin is added as a bait, but it is not necessary. With the boat at full sail, the fish, when abundant, are hauled out as fast as the fishermen can throw out and recover their hooks.

The indigenous fresh-water fishes of Tasmania are not numerous, and include only two or three that possess a commercial value. There is a large eel, *Anguilla australis*, very like our silver eel, but this is more abundant in the adjacent colonies. In the rivers that debouch upon the north-west coast are found the Blackfish (*Gadopsis marmoratus*), a near ally of the true cod family, and the Cucumber Mullet (*Prototroctes maræna*), near akin to the Salmonidæ.

To make up for the deficiency of indigenous fresh-water fishes in Tasmania very successful experiments have been made to introduce English varieties. Brown trout (*Salmo fario*) and salmon trout (*Salmo trutta*) have been successfully established in the colony, the former species attaining to remarkable dimensions. But the very strenuous efforts that have been made through a long series of years to acclimatise the European salmon (*Salmo salar*) have not unfortunately been attended by the same satisfactory results. Experiments conducted by myself on behalf of the Tasmanian Government, with a view to the solution of the problem, have demonstrated the regrettable fact that the waters around the coasts of Tasmania and Australia are too warm for the well-being of this king of fishes. The topic of the acclimatisation of European Salmonidæ at the Antipodes demands a lecture to itself, and cannot be further discussed on this occasion.

Let us now turn to the species more particularly characteristic of the continental Australian fish-markets. As already pointed out, the metropolitan centres lying approximately in the same latitude, their fish supplies contain many identical species. For instance, the large sea Mullet (*Mugil dobula*), of the same genus as our ordinary grey mullet and closely resembling it, while somewhat rare in Tasmania, is one of the leading fishes of the Sydney, Brisbane, Melbourne, Adelaide, and Perth fish-markets. In several of the colonies it is canned in considerable quantities, in addition to being largely traded in when fresh.

Probably the most familiar and cosmopolitan of the continental market fishes is the famous Snapper (*Pagrus unicola*), which in Sydney, Melbourne, and the other capitals is as highly prized as the Trumpeter in Tasmania. The Snapper belongs to the Sea Bream family, represented in the British seas by several species, none of which, however, attains

to the dimensions, or possesses the commercial value, of its Australian congener. Fine specimens weigh over thirty pounds, but, as in the case of the Trumpeter, those of half the size are most esteemed for the table. The contour lines of the Snapper are very bold and characteristic, and in some individuals are modified so as to give the fish almost a grotesque appearance, the frontal bones being sometimes with age developed into a forehead of fine intellectual appearance, and a large excrescence on the snout suggesting bibulous habits. Like the Trumpeter, this fish is caught by hand lines in deep water over rocky ground, the most attractive bait being squid or crayfish, though any kind of fish or even raw meat serves as well when the Snapper is on the feed.

Of other food fishes we may mention first the Flathead, of the genus *Platycephalus*, which has no generic representative in Europe, though it is of the same family group as the British gurnets and bullheads. One of the most widely distributed forms, it occurs in one or more of its twenty-odd species in abundance from Tasmania to Torres Straits. The much esteemed and delicately flavoured Whitings, of the genus *Sillago*, are in no way related to the European whitings, which belong to the true cod family, but are nearly allied to the Flatheads. Of the smaller kinds a prominent place must be given to the Gar-fishes, belonging to the genus *Hemirhamphus*, small cylindrical fishes with the lower jaw abnormally prolonged, just as the upper jaw of the sword-fish is on a much larger scale. They occur in vast shoals and are chiefly caught in small-meshed seine nets. Several of the species, owing to their abundance, convenient size, and delicate flavour, might no doubt be treated advantageously after the manner of the European sardine.

The varieties of fresh-water fish that are exposed for sale in the Australian markets are very limited in number, for, as most present are doubtless aware, the continent contains few rivers of really noble proportions. In fact, there is but one such, and that is the Murray, which measures 1400 miles from source to mouth, and is fed by numerous tributaries with courses varying in length from 350 to 750 miles. Its basin embraces large areas of all the colonies, except Western Australia, and contains waterways navigable by specially constructed flat-bottomed steamers for over 1000 miles.

Among the many excellent food fishes that this river produces, the Murray Cod (*Oligorus macquariensis*), a typical representative of the perch family, as its sharp-spined fins and other structural points indicate, takes precedence. As an illustration of the quantities dealt with, it may be mentioned that during the cooler months of the year no less than ten tons of this fish are despatched weekly to Adelaide alone, an at least equal weight to Melbourne, and smaller, though still large, quantities to Sydney and numerous inland townships. When full grown, the Murray Cod attains a length of three or four feet, and a weight of 30 or 40 or even up to 100 lbs. The fishery is conducted almost exclusively by hand and night lines, and the captured fish are kept alive until there are sufficient to send to market.

Australia is well known to be a land of anomalies. Yet if I tell you that the Murray Cod most commonly deposits its eggs in hollow trees, the statement may seem incredible. Such, however, is actually the case, for the spawning season of this fish occurs when the floods are out, covering the country for miles on either side of the river-bed, and the hollow trunks of submerged eucalyptus trees are then utilised by the fish as spawning-places.

Another excellent table fish, growing to a length of five feet, with a weight of nearly 100 lbs., is plentiful in the lower, salt-water reaches of the Murray, and in Lake Alexandrina, through which the river flows. This is the Mulloway or Jew-fish (*Sciæna antarctica*), which so closely resembles the European Maigre (*Sciæna aquila*) that it is regarded by some authorities as specifically identical with it. Of smaller forms the Murray contains gold and silver Perches, the Murray Bream, belonging to the genus *Therapon*, and a large Catfish (*Copidoglanis tandanus*).

Most important in the sub-tropical zone, from a potentially commercial standpoint, are the Herrings and Pilchards. One of the latter, *Clupea sagax*, not infrequently appears on the Victorian and New South Wales coasts in such countless thousands that carts have been filled with them by simply ladling them out of the sea in large baskets, and hundreds of tons have been sent up country to the inland markets, while coasting vessels have reported passing through closely packed shoals many miles in extent. Another species, *Clupea sundaica*, still more nearly resembling the British herring, and pronounced by experts to be as excellent eating, also occurs abundantly in Australian waters. There is also a Sprat (*Spratteloides delicatulus*) and several Anchovies (genus *Engraulis*), all belonging to the same herring family, to which up to the present little or no attention has been directed with a view to their commercial exploitation.

The toothsome Sardine, as many present will know, is not a distinct species of fish. The genuine article is the young of the pilchard, but those sold under the name are, oftener than not, sprats. Hundreds of tons at least of these preserved fish are annually imported from Europe and consumed in Australia, while the live fish are swimming in shoals off the coasts.

Several reasons may be advanced for the neglect of this important food-supply. In the first place, the capture of this class of fish in large and remunerative quantities demands the employment of drift or floating nets of voluminous dimensions and costly description. The boats, also, employed in such fishing must be well-found, substantial craft, fitted to keep the deep sea in all weathers. Then, again, with the present relatively small population of Australia—the population of all the colonies is less than four millions—an amply sufficient fish-supply can easily be obtained by the use of seine or set nets in the river estuaries, or so close in-shore as to be literally at the very doors of judiciously located fishing-camps. In the not very distant future, when the population shall have increased to such an extent as to create a demand for a larger fish-supply than can be yielded by the coastal waters, recourse will be had, I may safely predict, to drift and other methods of fishing

in the deeper waters, where there is undoubtedly a rich harvest waiting to be garnered.

Concerning the Tropical Australian fish fauna generally, it may be remarked that, with the exception of certain fresh-water species, it contains very few that are peculiar to Australia, or even that are specially characteristic of its waters. The majority of the species correspond to forms common to the Indian and Malay seas, and many are identical with fish exposed for sale in the markets of Colombo and Singapore.

A striking feature of this tropical Australian fish fauna is the occurrence of the types of the more temperate zones on a relatively colossal scale. Thus, the genus *Lates*, represented in Victoria by the sporting fish, popularly known as the Gippsland Perch (*Lates colonorum*) is represented on the northern coasts and in the tropical estuaries by the Giant Perch (*Lates calcarifer*), which commonly attains to a weight of 50 or 60 lbs. It is identical with the Cock-up, or Nairfish, of India, where it is highly esteemed for sport and for the table. A yet larger member of the perch tribe is the huge Groper (*Oligorus gigas*) which sometimes weighs 4 or 5 cwt. and, as its scientific name indicates, is closely allied to the comparatively small Murray Cod.

The most striking instances, however, of the enormous dimensions exhibited by allies of fish indigenous to temperate waters are perhaps afforded by the herring family, or Clupeidæ. Herrings three or four feet long one would expect to find only among the property for a Christmas pantomime. Yet such exist on the Queensland coast and in other tropical waters of Australia. The species most esteemed on gastronomic grounds is known in Queensland as the Milk-fish or Bony Salmon. Its scientific name, *Chanos salmoneus*, refers to the considerable resemblance it bears to the British salmon, which it sometimes equals or even surpasses in size. Another, still larger type, measuring occasionally no less than five feet, is the Ox-eye Herring (*Megalops cyprinoides*). Excelling all its congeners in the development of the fine bones for which the herring family is so famous, it is scarcely as great a favourite with the epicure.

It may be of interest to remark here that the celebrated Tarpon, which affords capital sport in the waters of Florida, is a species closely akin to the Ox-eye; its scientific name is *Megalops thryssoides*. Specimens of the Tarpon have been taken over six feet long and weighing 220 lbs. They are caught with salmon rod and tackle baited with a small bright fish.

The four-rayed Tassel fish (*Polynemus tetradactylus*), an excellent table fish, is known among the settlers of North Queensland as the "Salmon," the shape of its body and boldly forked tail giving it some resemblance to the fish properly so called. The tassel fish is also a native of India, where it is called the Bahmeen or Pamban Salmon, and where some examples weighing over 300 lbs. have been recorded. Both this and other species, several of which are met with in Australian waters, are highly prized in India for the isinglass of excellent quality that can be extracted from their sounds or swimming bladders, and they could no doubt be likewise turned to profitable account in Australia.

The King-fish of North Queensland (*Cybium Commersoni*) is a gigantic

representative of the mackerel tribe. Under the name of Seer it is held in high repute in India, both for the table and for the sport it affords.

Two species claim attention on account of their scientific interest rather than by their commercial importance. The well-known Lung fish (*Ceratodus Forsteri*), one of the few surviving members of the ancient order of the *Dipnoi* and the true Barramundi (*Osteoglossum Leichhardti*) are strictly confined to certain rivers in Central Queensland, and share with one another the very remarkable distinction of having no other surviving allies except in the fresh waters of Africa and South America.

In the case of *Ceratodus*, these allies are generically distinct, the surviving forms being *Lepidosiren* and *Protopterus*, while the Barramundi is represented in South America by one species of the same genus, *Osteoglossum bicirrhosum*, and a related type, *Arapaima gigas*, notable as being the largest teleostean fish discovered: it attains a length of over fifteen feet.

The existence of nearly related fresh-water fishes in such remote regions is of special interest with respect to the support it affords to the geological theory, first propounded by Professor Huxley and further developed by Darwin, Wallace, H. O. Forbes, and others, that these now isolated lands were formerly closely connected.

From the estuary of the Endeavour, near where Captain Cook's vessel, the *Endeavour*, was beached in 1771, I obtained a large species of flat-fish, previously unknown in Australia, though already recorded in India. This fish, *Psettodes erumeus*, growing to a weight of several pounds, is very much like the halibut, but is much more delicate, and may at some future time be found worthy of a special fishery.

The Archer, or Rifle, fish, *Toxotes jaculator*, popularly known in Queensland as the Spotted Bream, has the singular habit of bringing down, by the dexterous discharge of a pellet of water from its mouth, the flies and other insects which settle on the water-lilies and other aquatic plants in the backwaters and lagoons it most affects. I have seen the Rifle-fish thus strike its prey at a distance of several feet.

Leaving now the ordinary fishes, we will next consider the oysters and oyster fisheries of Australia. There are several species of oyster which are edible, and consequently possess an economic value. Only two, however, grow in such quantities as to form the objects of fishing industries, or of more or less elaborate methods of artificial cultivation.

The oyster indigenous to the Southern Australian coasts and the colder waters of Tasmania is indistinguishable specifically from the British native (*Ostræa edulis*), and is regarded by specialists as a variety of that species. In former days this oyster was so abundant on the Tasmanian coast that in a single year supplies to the value of £100,000 were exported to the neighbouring colonies. But the drain on the natural beds was so great, while no measures were taken to reserve a breeding stock, that in a few years the industry became practically extinct, and the oyster almost exterminated. Equally improvident has been the exploitation of the oyster-beds in Victoria and West Australia, and now only at Adelaide is the *Ostræa edulis* regularly offered for sale.

Among the official duties that have within the last few years devolved upon me as Commissioner of Fisheries to various Australian colonies, has been that of endeavouring to resuscitate the oyster fisheries. This task I have, as far as practicable, initiated by collecting together all the accessible supplies of the indigenous oysters and placing them in judiciously selected and strictly guarded Government reserves. Suitable contrivances were at the same time laid down for the attachment of the floating spat. These reserves have served as nurseries for the restocking of the depleted oyster grounds in their immediate neighbourhood, and when once thoroughly established and systematically maintained, will undoubtedly in time accomplish the results aimed at. Already the reserves established by me at Spring Bay and elsewhere on the Tasmanian coast, some few years ago, have been the means of so far restocking the formerly exhausted grounds in their vicinity that these are now profitably leased by the Government as private fisheries.

The reckless exhaustion which threatened the total extinction of the oyster fisheries in Tasmanian and other southern waters has fortunately not been extended to that second species of commercial oyster which is indigenous to the sub-tropical and tropical coast-lines. This is the Rock-Oyster (*Ostræa glomerata*), which derives its popular name from the circumstance that its most characteristic habitat is a rocky foundation, to which it adheres in great masses, whereas the ordinary species, resembling the British type, is commonly known in Australia by the somewhat derogatory name of Mud Oyster.

The Rock Oyster, however, is a most ubiquitous species, by no means limited to a rocky habitat. Strange and usually discredited tales were brought home from the Antipodes by travellers in the early colonising days concerning oysters that grew on trees. This seemingly anomalous situation is very commonly affected by the variety now under notice. The trees on which it grows are necessarily of aquatic habits, and they belong almost exclusively to that peculiar group, embracing many unrelated species, which are popularly known as mangroves. The mangroves all grow within reach of the tide, and their roots are left high and dry at low water. The Red or Orange Mangrove (*Rhizophora mucronata*) is a form very commonly associated with oyster growth, its complex labyrinth of aerial roots offering especially favourable bases for the attachment of the molluscs, which are sometimes so thickly crowded together that several bushels may be gathered from a single tree. Yet more abundant harvests are gathered from the White Mangrove, as it is called in Australia (*Avicennia officinalis*). The singular vertical offshoots from the roots of this tree, popularly known as "cobbler's pegs," which perform the functions of respiratory organs, act to a remarkable extent as spat collectors, and are sometimes entirely concealed by the mass of oysters that has accumulated on them.

A very characteristic condition of growth of this oyster, independent of the assistance of mangroves, is the formation of large banks, sometimes several feet in depth and many acres in extent. Growing thus closely crowded together, they naturally do not attain to their full development, or acquire their full flavour; nor, indeed, do they under

any circumstances within the tropical zone. When, however, they are transported south, carefully separated and spread out on the cultivated beds in Moreton Bay or Wide Bay, they rapidly improve in size and condition, and within a couple of years are equal to any that are placed on the market.

Another typical illustration of Australian contrarieties is furnished by the relation of the oyster to the whelk. On English beds one of the most destructive enemies of the oyster is a small whelk which bores into and destroys the animal. In Australia, on the other hand, the whelk, a species of *Potamides*, lives for the convenience of, and is destroyed by, the oyster. The spat becomes attached to the whelk, and the young oysters are carried about by this shell-fish among the rich pasture-grounds of the weed-covered banks. As the encumbrance grows, the whelk finds its movements seriously impeded, and is finally weighed down and suffocated in the soft mud, while the oysters raised on its back enjoy the most favourable conditions for their further growth and multiplication.

The most prolific development of the Australian Rock oyster is attained in situations alternately submerged and exposed to atmospheric influences, and within the tidal limits the oysters are most abundant at half-tide level.

The cultivation of the Rock oyster, though not pursued on such an elaborate system as in France and other European countries, is, in Queensland more especially, a highly important industry. The spat, which is produced in all seasons of the year, though chiefly in summer, is so abundant, and so readily adheres to every surface presented, that little occasion has arisen for the employment of special spat collectors. As an experiment, however, I laid down on one of the Queensland oyster-beds what proved very efficient collectors. They consisted simply of thin boards weighted by a brick fastened at either end, which also raise them a few inches from the ground. The under surfaces were coated with cement, to which the young oysters very readily adhere. This form of collector also proved successful in Tasmania, and might, I think, be advantageously employed on British oyster-beds.

An oyster of scientific interest was discovered by me in the estuary of the Ord river, Cambridge Gulf, West Australia, and described under the name of *Ostræa ordensis*. It is remarkable both for its small size—fully matured specimens measure not more than a quarter of an inch in length—and because it grows not only on the stems, roots, and "cobbler's pegs" of the mangroves, but also on their leaves. Forty or fifty are sometimes crowded together on a single leaf so far above half-tide mark that they are covered with water only for a few hours each day.

Time presses, and I must now pass on to a brief consideration of another subject—that of the Pearl and Mother-of-Pearl fisheries. Those fisheries constitute one of the leading industries in Australia, the annual value of the pearls and pearl-shell exported ranging from £250,000 to £300,000.

The particular species of mother-of-pearl shell that is the object

of this industry, *Meleagrina margaritifera*, is confined to tropical waters, and is found on all the coasts of Australia within the Tropics. Torres Straits, the coast of North Queensland, and the north-western sea-board of West Australia are, however, the chief seats of the industry. Formerly the shells were gathered in abundance by wading at low water on the coral reefs, but now these supplies are exhausted and the fishery is almost exclusively prosecuted, with the aid of diving apparatus, in depths varying from five or six to as much as twenty fathoms. Fine examples of the shell weigh from five or six to ten or twelve pounds a pair, and the best quality fetches in the London market over £200 per ton.

The pearls obtained are comparatively few, but their value equals on average a tenth or an eighth of that of the shells collected. They are least frequent in the best and healthiest shells. About three years ago a patch of mother-of-pearl shells was discovered off Onslow on the West Australian coast. The shell was poor, but a few tons' weight of it yielded pearls to the value of over £10,000.

Some of these pearls assume very eccentric shapes. One of the most remarkable combination of pearls is that known as the "Southern Cross," which was obtained on the coast of Western Australia in the year 1874, and was exhibited in the Indian and Colonial Exhibition of 1886. It consists of a series of nine pearls, seven of which are consolidated together in a straight line, while the other two, attached on either side, complete the form of a cross.

The knowledge of the fact that the mother-of-pearl shells formerly abounded in shallow water, induced me to experiment on their cultivation, and the results obtained in Torres Straits and Western Australia show that, should the natural supply begin to fall off, the breeding of the pearl oysters is capable of development into a profitable industry. With, in fact, the increasing difficulties that are even now experienced in obtaining remunerative quantities of shell from what were but a few years ago most prolific fishing-grounds, there can be but little doubt that systematic cultivation, as with ordinary oysters, will have ere long to be resorted to in order to safeguard the mother-of-pearl shell fisheries from ruinous depletion. Although mother-of-pearl shell presents many difficulties, as compared with the ordinary oyster, with relation to its suggested cultivation, these difficulties are by no means insurmountable, as I have demonstrated by operations successfully conducted under very varying conditions. Even specimens laid down in a tidal pool in a mangrove swamp, near Broome in Roebuck Bay, increased in size within twelve months and commenced to multiply, numerous shells being found adhering to the parents. An experimental colony of this tropical pearl shell was, moreover, successfully established by me at a point (Shark's Bay) on the Western Australian coast, outside the Tropics, and considerably to the south of its natural habitat, and proved itself capable of both thriving and propagating under these abnormal conditions. It is a subject of much satisfaction to myself, that as an outcome of my practical success in this direction the Queensland Government has decided upon immediately inaugurating the systematic culture of pearl

shell on their coast-line. The commendable foresight which they are exercising in this direction will, without doubt, unless the neighbouring colonies speedily follow suit, secure for Queensland in the near future that pre-eminence in the production and output of this valuable marine product which she already possesses with relation to esculent oysters.

With the cultivation of the mother-of-pearl oyster is connected, it may be further mentioned, the possibility of bringing about the artificial production of pearls, and this fact will probably of itself be sufficient stimulus to extensive operations in this direction. My personal experiments have demonstrated that the idea is not altogether a visionary one.

The Trepang or Bêche-de-mer fisheries are conducted under much the same conditions and in the same situations as those associated with that of the mother-of-pearl shell; they may, therefore, appropriately receive attention in the next place.

Trepang is the Malay term for those edible varieties of *Holothuridæ* or sea-slugs, belonging to the class of the *Echinodermata*, that are collected and preserved in large quantities throughout the Eastern tropical seas for the Chinese market. The varieties indigenous to the Great Barrier Reef of Queensland enjoy a very high reputation, so that from £15,000 to £20,000 worth of the article is annually exported to China from this coast. The fishery of the Bêche-de-mer is conducted in a very simple manner. The organisms are gathered by Australian natives from the surface of the coral reefs, or in the pools left by the receding tide. When a sufficient quantity has been collected, it is carried to the central curing station. Here the slugs are first stewed in their own juice in large iron caldrons for a certain length of time. Then they are taken out, cleaned, partly dried in the sun, and lastly transferred to the smoking house, where the drying process is completed, after which they are ready to be packed in bags for export.

Time will not permit me to dwell at length on the Dugong, Turtle or Tortoise-shell, and other minor fisheries prosecuted in tropical Australian waters, or to make more than a brief allusion to the beautiful coral reefs, which, with their varied forms and rich tints, assume the semblance of flower-beds in full bloom, among which these fisheries are prosecuted. Some of these reefs remain uncovered for less than half an hour, while at high tide they are submerged to a depth of four or five fathoms. Apparently the water leaves the reefs so much exposed, as they were when I photographed them, at very uncertain intervals. During several years I repeatedy failed to accomplish any really satisfactory results. What I still more regret is, that when last year my friend Professor Louis Agassiz fitted out a special expedition to further explore the marvels and mysteries of this veritable wonderland, having engaged a trained staff of artists, photographers and other experts, both the weather and tides were so unpropitious that little, if any, of the work planned out could be accomplished. However, with the commendable pertinacity that distinguishes the Anglo-Saxon race in all quarters of the globe, he contemplates returning to the charge.

In conclusion, I may remark to those specially interested in the

subjects that have been touched on, that they will be found more fully dealt with in my volume, *The Great Barrier Reef of Australia*, and in a forthcoming work, *The Naturalist in Australia*, to be published shortly.[1]

THE UNITY OF THE EMPIRE.

(*Abstract of Lectures delivered before the Society by Professor J. Kirkpatrick, M.A., LL.D., and Professor G. W. Prothero, M.A., D.Litt., in January and March* 1897.)

The Anglo-Saxon Race.

I.

These three addresses are intended as an Introduction to the important problem of the further consolidation and unification of the British Empire. Pessimists are fond of predicting the loss of India and the severance of the Colonies from the mother-country; but such general disintegration would be a reversal of all historical evolution, and particularly of that of modern times, when the general tendency is in the direction of consolidation. Suffice it to name America, Germany, Italy, and Switzerland as examples. The decline and fall of the British Empire, it is sometimes said, will some day be as pitiable as was that of the Roman during the century before the abdication of Romulus Augustulus. But it is idle to compare one of the dreariest periods in the world's history with the brightest and most prosperous. There are indeed disruptive elements at work within our own empire; but it is our hope and belief that their effects are many centuries distant, and it is our duty to point out, combat, and counteract them. But, say some of our critics, our objects are narrow and self-seeking. If we sought to promote the unity and welfare of the whole human race, they would approve; but they disapprove of our selfishly looking after our own interests alone. We reply that both duty and charity begin at home, and we are more likely to promote the world's welfare by minding our own business than by interfering with that of others. Others object that our aims are too ambitious. Better devote our whole attention to our own peculiar heritage—this England, this precious gem set in the silver sea—than rove all over the world in eager quest of new acquisitions. But nature enjoins man to be fruitful and multiply and replenish the earth. In obedience to that law, our ancient ancestors migrated from their Germanic and Scandinavian homes to found a "Greater Anglo-Saxony," and in similar obedience our later ancestors have founded "Greater Britain." In a word, evolution and expansion are immutable laws which we must obey; the penalties for disobedience to them are stagnation, retrogression, and ruin. And further, if shorn of its colonies and dependencies, the United Kingdom, which derives two-thirds of its food from abroad, would run imminent risk of starvation in the event of any great continental war.

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[1] The foregoing address was voluminously illustrated by a series of lantern slides, prepared from Mr. Saville-Kent's photographs, depicting the characteristic food-fishes of the several regions enumerated; the variable conditions of oyster growth on the Australian coast-line; and the reef scenery among which the mother-of-pearl shell and Bêche-de-mer fisheries are conducted.

First, a few words as to the origin, language, character, and institutions of the Anglo-Saxon race. The laws of evolution apply to ethnical as well as to natural science. Evolution is not the mere growth of a single germ. It implies blending, crossing, grafting; it implies the selection, appropriation, and assimilation of foreign elements. Of such evolution our modern nation is the product. It is a rich and vigorous blend of the orderly, methodical, stolid Saxon and Anglian races with the gifted and impulsive Celtic race, mingled with Norman and French blood, and influenced by Roman culture. That we are a very mixed people is sometimes supposed to be a taunt; in reality it is our strength. The purest races, however gifted, are not, in the long-run, the most enduring and the most successful. What, for example, has been achieved by the pure Celt, the pure Slav, the pure Semite? Of the same evolution the English language is another striking product. With its three-fourths of Germanic and Scandinavian words, and its composite one-fourth borrowed from French, Latin, Celtic, and other languages, it faithfully mirrors the origins of the people who speak it. Its practical merit consists in its almost unique freedom from inflexions, genders, and other grammatical fetters, and it is therefore, as a rule, much more easily learned by foreigners than their languages by us. However rich or euphonious, precise or poetical, they may be, can any one imagine German, French, Italian, or Russian becoming a great colonial and cosmopolitan language?

Our national character has also necessarily been formed in accordance with the same laws of evolution and expansion. We owe that character to the mixed ancestry already mentioned; we owe it also to our mixed and varied education. Edward III. was at one time master of one-third of modern France; Henry V. was to have been regent and ultimately king of the whole. Englishmen of the upper classes were almost as much at home in France as in England; still more so were Scotsmen, for their ancient league with France subsisted for the three centuries prior to the Union of the Crowns. To such foreign travel and intercourse, dating from Anglo-Saxon times, and to the Crusades, to continental literature, art, and institutions, we are deeply indebted. Necessarily, too, our institutions form part and parcel of our national development, and they too have been imported. Our boasted principles of representation, self-government, and limited kingship were familiar to Teutons, Franks, and Gauls, and even to the Romans of the ancient *municipia*. On the Continent they were crushed out by the necessities of the feudal system as a scheme for mutual self-defence; with us they have survived and thriven, thanks to the genius of great monarchs and national heroes—William I., Edward I., William III.; Langton, Montfort, Wycliffe, Hampden, Pitt—thanks also to our insular position.

To the first stage of our national development belongs the history of what I have called, in my brief syllabus, "Greater Ireland." To Ireland we owe our earliest national and independent Church. While our Anglo-Saxon ancestors were sunk in the night of paganism, Ireland was pre-eminently Christian. Its numerous religious houses were cradles of letters and art; its pious monks converted Wales, Scotland, and Northern England long before St. Augustine set foot in Kent; and it was by Irish missionaries that Germany and Switzerland were first Christianised. To Ireland, to the Celtic Church, and to the Celtic element in our race, our nationality likewise owes deep gratitude. Surely all these rich and manifold factors in our national evolution and expansion are full of rich promise for the future.

II.

In the development of the Anglo-Saxon race there are three stages—those of racial fusion, political consolidation, and national expansion. Let us note a few of

their chief landmarks. For six centuries after the advent of Hengist and Horsa the island was gradually filling with the actors who were to perform a new drama in the world's history. The Conqueror, with his Scandinavian Normans and French adventurers, was the last to arrive. Not a single new invader has set foot on our shores since. The makers of the nation were now assembled in full force. Most of them belonged to the same Germanic or Scandinavian stock, and most of them were orderly immigrants, desirous of founding a new home. Left to themselves, they would have doubtless established a number of petty feudal principalities, as on the Continent; but the genius of the Conqueror welds them into a harmonious whole. His repudiation of papal overlordship, his Domesday Survey, and the Salisbury Oath seal the national individuality and independence. By the close of the twelfth century, after the practical extinction of the rebellious Norman barons, the fusion of the races is complete, while Henry II.'s partial conquest of Wales and his acquisition of the overlordship of Ireland mark the beginnings of a "Greater England." And this stage of development culminates in the Great Charter, framed by Langton, a true Englishman, and extorted from the king by the patriotic English baronage.

And almost simultaneously with the passing of Magna Charta expires the old Anglo-Saxon Chronicle, an event which further serves to introduce the period of political consolidation. Half a century passes. Grossteste in Church and Montfort in State vindicate the national liberties, the latter paving the way for the complete Parliament summoned by Edward I. Little was the Great Plantagenet aware that with his famous "*quod omnes tangit*" he was laying the foundation of modern constitutional government. By his wars, too, he contributed unconsciously to the later development of the nation. For his hostility to France and his designs against Scotland led to the close alliance of these two countries, which gave an immense impetus to Scottish travel, enterprise, and education, both in France and in other parts of Europe. Little Scotland may fairly claim the title of "Greater Scotland" during the centuries when her name and her influence were carried abroad by such men as William Wallace, the soldiers of the Scottish Guard, George Buchanan and John Knox, Law and Paterson, Stair the ambassador, and Keith the marshal. And this great international training has benefited modern Scotland and the modern Empire alike. To France Scotland mainly owes her University system, her Court of Session, and her enlightened law. She even owes her "gigot" of mutton, the "ashet" on which it is served, and the luscious "haggis." And Scotland, in turn, has contributed largely to the literature and education of England and to the building up of our Indian and Colonial Empire.

Our second and third stages of development, those of political consolidation and national expansion, run parallel from the time of the Great Plantagenet down to the present day; but for three centuries the former is by far the more important. Prior to the Stuart era one need but name such outstanding events as the making of modern English by Chaucer, Langland, and Wycliffe, and our own John Barbour; the vindication of the right of private judgment, in matters civil as well as ecclesiastical, by Wycliffe; and the constitutionalism of the Lancastrian *régime*. After the fall of the Stuart dynasty we are familiar with the new kingship, cabinet government, religious toleration, parliamentary reform, and the modern triumphs of science, art, and industry, of literature and education. Prior to the Stuarts, especially during the last quarter of the fifteenth century, the way for the stage of expansion was paved by such epoch-making events as the introduction of printing and the discovery of America. With the accession of the Stuarts the tide of expansion fairly sets in. Suffice it to mention the Greater England gradually formed by the founding of the colonies of Barbadoes, Virginia, Plymouth, Massachusetts,

Connecticut, and others. In the infancy of the race the watchword of our ancestors, "Westward Ho," had heralded the foundation of England; it now ushers in the foundation of a new and Greater England. Prior to the Union of England and Scotland there had been a Greater Ireland and a Greater Scotland also. Since that Union, and since the Union with Ireland, the combined national forces have established a Greater Britain. Such, in briefest outline, has been the process of our national evolution and expansion, the fruitful process of appropriation and absorption of extraneous elements by a vigorous parent stem. The product of that evolution is our British Empire, at once a splendid heritage and a sacred trust.

III.

Having glanced at the genesis of our Empire, we shall next examine the principles on which it has been founded, in order that we may better understand its present and forecast its future. Be it remembered that most of our Teutonic and Scandinavian ancestors were peaceful settlers, obeying the natural laws of expansion, and not adventurers in quest of plunder. True to the unity and continuity of their race, the founders of our modern Empire have in the main obeyed the same laws and been actuated by the same motives. As a man sows, so shall he reap; and, as a rule, the seed sown by our colonists has been good seed. The hardy, industrious, God-fearing pilgrims of the *Mayflower* and the other Puritan emigrants who founded the colonies of New England are typical, and they are justly regarded by the Americans as the true founders of their great nation. The Southern Colonies, on the other hand, tainted with slavery from the outset, in accordance with the example set by Virginia, have reaped the penalties of civil war and an unduly large negro population. Typical of these colonies is Georgia also. Its philanthropic founder, General Oglethorpe, had forbidden slavery and restricted the importation of spirits, and the colony had prospered; but these prohibitions were afterwards abolished, and with the free importation of rum and negroes the colony fell under the same blight. Striking as are the differences between the evolution of the Northern and Southern Colonies, differences which it required a terrible Civil War to obliterate, the English Colonies present a still more striking contrast to those of France, Spain, and Portugal. The English, Irish, Scottish, Dutch, German, Huguenot, Swedish, and other colonists of the North have been, as a rule, orderly, peaceful settlers, replenishing the waste places of the earth. Cortes in Mexico and Pizarro in Peru were hostile invaders of regions already well peopled, adventurers ambitious of dominion, marauders thirsting for gold. Some of the Spaniards, undoubtedly, had the interests of their country and their Church at heart; but they erred in supposing that empires can be founded or religion promoted by fire and sword, robbery and murder. Mexico and Peru are typical of the South American Colonies. The Mexicans and the Peruvians had a singularly troublous and chequered career down to their emancipation from the Spanish yoke in 1824, and have since had their disastrous wars and revolutions; somewhat similar is the history of all the Spanish and Portuguese conquests and settlements; and very typical is the modern object-lesson of Cuba.

While the English colonists were, in the main, pious and peaceful settlers, and the Spanish were often cruel and ruthless marauders, the French may be described as strategic explorers. They began to colonise Canada half a century before the era of the *Mayflower*, and they afterwards settled in Acadia, and founded Quebec. But their most characteristic achievements were the ascent of the St. Lawrence, the descent of the Mississippi, and the formation of a formidable chain of forts, stretching from the mouth of the former river to that of the latter, and admirably

calculated to bar the English Colonies from farther westward progress, and to secure to France the immense basins of the Mississippi and the Ohio. Even had it not been frustrated by the genius of Pitt and the heroism of Wolfe, this ingenious policy would probably have failed in consequence of an inherent defect. For it was based, not on a natural and necessary expansion of the French people, but mainly on military enterprise. "What France requires," wrote the correspondent of the *Figaro* from the Far East, a few years ago, "as she has no surplus population, is to get possession of fertile regions with docile and industrious inhabitants who will work for her." Apparently very desirable. But can a nation reap where it has not sown? Briefly then, in order to be successful, colonisation must mean emigration, peaceful expansion, lawful enterprise; it must imply that the colonies are free, and not mere bondmaids of the mother-country; it must involve the unity and continuity of the race, with all its traditions, its culture, education, and religion.

A consideration of the true principles of colonisation will help us to solve our modern problems, and in particular that of the further unification and consolidation of the Empire. Inseparable from these principles is that of constitutional liberty, and such liberty is best secured by means of representative government. Closer union is highly desirable, because union is strength and disunion means ruin. But it must not be an artificial or mechanical union; it must be an organic growth, the fruit of all the time-honoured principles and traditions of the nation. Of the many schemes that have been suggested, one, and one only, seems to promise success. As the United Kingdom has its so-called Imperial, but mainly Insular, Parliament, so the Empire should have its true Imperial Council. Government by parish, town, and county councils is local in contrast to central government by Parliament; our Parliamentary government, however important, is but local compared with the great central government demanded by the interests common to the whole Empire. Our great heritage has been built up on the sound principles of historical evolution. It is only by continued obedience to these principles that we shall be enabled to hand it down to posterity greater and more glorious still.

J. KIRKPATRICK.

THE BRITISH COLONIAL EMPIRE.

The course of four lectures was designed to present certain connected aspects of the imperial question, (1) The principles and motives which have governed British foreign policy during the last three centuries and a half; (2) The results of that policy as seen in the creation of a colonial empire; (3) The principles of federation in general, and their application in existing federal states; (4) The possibility of applying these principles to the British Empire.

Lecture I: British Foreign Policy.

The foreign policy of this country has been determined by certain conditions, permanent and temporary; and in accordance with the latter, its history may be divided into certain epochs. The modern tendencies of our policy were determined in the reign of Elizabeth. The Reformation, by setting up hostility with Spain, launched this country on a career which it has followed more or less closely ever since. Religious freedom and commercial expansion were the most potent motives during the latter half of the sixteenth century. In the time of the Stewarts, dynastic interests largely perverted the conduct of our foreign affairs, and a great opportunity was lost during the Thirty Years' War. The policy of

Cromwell was in the main a return to that of Elizabeth. A fatal blow was dealt at Spain, and the Dutch now became our chief commercial rivals. The later Stewarts, by a policy of subservience to France, allowed that power to rise to a dangerous height. The Revolution of 1688 was made almost as much with a view to altering the foreign policy of Great Britain, as with a view to altering domestic government. It set up an antagonism between Great Britain and France, which led to seven or eight great wars, caused principally by a collision of colonial and commercial interests. A balance of power in Europe, the establishment of a naval supremacy, and the acquisition of a colonial empire, were the chief aims of British policy from 1688 to 1815. Since 1815 our policy has been more and more largely determined by colonial and commercial considerations. Down to 1848 we intervened on several occasions on behalf of national or constitutional liberties. Since that date we have practically stood aloof, except in regard to the Eastern Question, which has always been held to be closely connected with the interests of our great dependency, India. Egypt and Africa have of late held a prominent place in our foreign policy, for similar reasons. But more and more our foreign policy has become one of peace, which is now our chief interest as a great colonial and commercial state.

Lecture II: Colonial Expansion.

The history of our colonial expansion may be divided into epochs similar to those of our foreign policy. In the reign of Elizabeth there was great commercial advance: voyages of discovery were undertaken: great trading companies were formed: vigorous and partially successful attempts were made to break down the Spanish colonial and commercial monopoly. The attempts at colonisation made by Gilbert, Raleigh, and others, were failures, but pointed the way to ultimate success. During the next century the foundations of our colonial empire were laid, both in India and America; in the former by the East India Company, in the latter by the settlements in Virginia and New England, the annexation of the Dutch colonies in North America, and the occupation of several West Indian islands. The American colonies grew steadily, and became prosperous and semi-independent communities. During the period following the Revolution of 1688, our power and interests in India and America came into collision with those of France, and in a less degree with those of Spain and Holland. This is the "Sturm und Drang" period of our colonial history. The war of the Spanish Succession, ending with the Peace of Utrecht, marks the first great step in advance. The two great wars in the middle of the century, ending with the Peace of Paris, gave us the supremacy both in East and West. In the war of American Independence France took her revenge in America, but could not loosen our hold on India. Finally, in the course of the great struggle with the Revolution and Napoleon, we not only established ourselves more firmly than ever in India, but laid the foundations of our South African empire by the conquest of the Cape, not to mention other acquisitions. During the present century, the advance of our colonies and dependencies, in area, population and wealth, has been more rapid than ever before, but it has been by peace, not war—that is to say, not by war with European Powers. A vast new dominion has grown up in Australasia, Canada has expanded westward, the Cape Colony has made immense progress, and in the "scramble for Africa" the best portions seem to have fallen to our share. At the same time, the control of India has been fully taken over by the home-government, while the greater colonies have become self-governing communities. The colonial problem is now, therefore, no longer how to grow, but how to hold together.

Lecture III: The Principles of Federation.

States may be classified in various ways, according to the nature of their society, the extension of political rights, etc. The method best adapted to bring out the relation of a federal state to other kinds of states is to classify them according to the greater or less centralisation of power. States are either unitary or composite, ranging from the simple city-state of Greece or mediæval Italy to the great country-states, such as France or Russia in the present day. The essential distinction between such states and a federal state is that, while in the former class the central government is absolute, and can deprive the local governing bodies of any powers that they may have been allowed to exercise, in the latter class the central government cannot deprive the local governments of their rights, or can only do so by a more or less elaborate process, and with the consent of a large majority of the local governments themselves. Of federations, or composite states, there are two kinds—the strong and the weak (Bundesstaat and Staatenbund). The chief distinction between these is that in the former the central government deals directly, within its own province, with the individuals composing the nation, while in the latter the central government can only exercise control through the state-governments. All existing federations (except the newly established confederation of Central America) belong to the former class, but all these (except the dominion of Canada) have passed through the weak phase. An examination of the political systems of the United States, the German Empire, Switzerland, and Canada, shows a general similarity of outline, but great and important variations in detail, as regards the three great departments of government—the executive, the legislature, and the judicature. In each of the four great federations there are two legislative bodies, representing more or less the independence of the states (*i.e.* the federal principle), and the equality of the individual (*i.e.* the democratic principle). In each, again, the central government has large, though limited, powers: it controls foreign relations and military affairs: it levies taxes, and maintains free-trade between the states. In each, the tendency, on the whole, seems to be towards the growth of the central power at the expense of the state-governments.

Lecture IV: Federation in the British Empire.

The British Empire is, from one point of view—seen from the outside—a unitary state; from another point of view—seen from the inside—a confederation of the weaker sort. The central government cannot interfere at all in the domestic affairs of the greater colonies; but, on the other hand, these colonies have no share in managing foreign affairs. There are peculiar difficulties in the way of federating the British Empire—the great distances separating its parts, and the fact that it is the ocean which separates them: the variety of pursuits, of climates and products, and the consequent divergence of interests, which emphasise this separation and tend towards disruption: the great difference in wealth, population, traditions, society, etc., between the mother-country and the colonies: the question of free-trade *v.* protection: the reluctance of the governing classes of Great Britain to give up any political power. All these difficulties are, however, in process of being reduced, though the first, at all events, will always remain a serious obstacle. The conditions which have led to federation in most other cases—a pressing national danger, or a struggle for existence—have not yet appeared in our case, but they may make their appearance any day. Assuming that it is desirable, in the interest both of the colonies and of the mother-country, that the empire should hold together, and assuming further that the existing system cannot be indefinitely maintained, the chief question is what form it is desirable that British Federation should ultimately

take. It should undoubtedly be a strong federation, and should probably more nearly resemble that of Canada than that of any other existing federal state ; but in some important respects it should adopt the principles of the German Empire. Such a consummation being, however, to all appearance, a long way off, the more pressing question is, what steps should be taken to ensure against disruption, and to pave the way towards a more perfect union. The first stage must be to give the colonies some share in the control of foreign and naval affairs, provided they consent to bear a share of the burden of national defence. It would appear that such a step might be taken without much disturbance of existing conditions and institutions. On this foundation an advance might subsequently be made to a real Britannic Federation. G. W. Prothero.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lecture delivered in May.

Sir Henry Tyler read before the Society in Edinburgh, on May 7th, a paper on "The Geography of Communications." Sir Thomas Clark, Bart., presided.

The Cabot Commemoration.

John William Stirling, Esq., M.D., C.M., L.C.P.& S. (Glasgow), of Montreal, and Joseph J. Henderson, Esq., C.E., of New York, have been appointed delegates to represent the Society at the General Meeting of the Royal Society of Canada, to be held at Halifax, Nova Scotia, from the 21st to the 26th of June, when the famous voyage of the Cabots to North America in 1497 will be commemorated by the erection of a monument, or the placing of a tablet in the Province Building of the city.

Closing of the Rooms.

The Society's Rooms will be closed during August for cleaning, etc.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The German Geographical Congress.—Our Corr. Member, Professor H. Wagner of Göttingen, has kindly sent us the following report :—

From the 20th to the 23rd of April the German geographers were assembled in the small University town of Jena, to hold their twelfth meeting. These gatherings take place every other year, as a rule at the headquarters of a geographical society, of which Germany possesses so many, the number within the boundaries of the Empire being twenty-one. Large capitals and commercial towns having been hitherto selected for the meetings of the Congress, it was this time resolved to try what attractions a small midland town would have for geographers. To the astonishment of every one, the number of the members was not less than 583, of whom 225 were visitors—a number hardly surpassed at Berlin and Vienna—while the 358 members from the town itself, out of a population of 17,000, showed an unusual interest in the subjects discussed, for this number considerably exceeds the contingent furnished

by Bremen in 1895, and even by Berlin in 1891. Foreign countries also sent representatives, for instance, England, Norway, Russia, Hungary, and America. There was no exhibition this year.

Five long sittings were spent on very important discussions, and the procedure adopted for some time past of submitting for consideration in each sitting only cognate subjects proved very satisfactory.

The first sitting, on April 21st, was, as usual, devoted to the extension of our knowledge over the area of the globe (exploration). It was opened by one of the Nestors among the geographers of Germany, Dr. Neumayer of Hamburg, with a report on the work of the South Polar Commission. This Commission was appointed at Bremen in 1895 to examine the question of a German expedition to the Antarctic lands. Unfortunately, Dr. Neumayer was able only to report that, by numerous lectures in the towns of Germany, and by means of pamphlets and newspaper articles, the problems awaiting solution in Antarctica had been made clearly comprehensible to the public, and that much interest had been shown in the matter. As to the course of the expedition a general scheme had been agreed upon. The starting-point for an expedition under the German flag was to be the island of Kerguelen, from which an attempt would be made to penetrate into the Polar seas. It was intended that at least one winter should be passed on the Antarctic coasts. The expenses of an expedition, properly equipped for scientific work, were estimated provisionally at £47,500.

It was at present, in the opinion of the Commission, too early to collect subscriptions to a fund for South Polar exploration. Efforts to this end could only be successful when a competent leader had been found, and the details of the plan had been worked out. From communications made to the Geographical Congress, it appeared that there was now a prospect of obtaining the services of an efficient naval officer. When this was done, the agitation would be commenced on a large scale. A finance committee was chosen with this object.

As explorers appeared two young Germans, who had equipped at their own expense, and carried out successfully, expeditions to Brazil and Asia Minor respectively. Dr. Herrmann Meyer, a younger brother of the well-known climber of Kilimanjaro, Dr. Hans Meyer (*S.G.M.*, vol. vi. p. 156), has, accompanied by Dr. Ranke, continued the researches of Dr. von den Steinen on the natives of Central Brazil. Travelling northwards from Cuyabá, he followed the Jatoba, an affluent of the Xingu entering on the left bank, as far as 12° S. lat., returning up the Kuliseu and again crossing into the basin of the Jatoba. The ethnological collections from the Trumai, Nabuqua, and Akuku tribes, who have up to the present hardly come at all into contact with white men, are exceptionally valuable.

Herr Roman Oberhummer of Munich travelled in 1896 with Dr. Zimmerer from Lycia and Cilicia into Central Anatolia (Cappadocia), having, by the advice of Heinrich Kiepert, set himself the task of exploring the region between Kaisarie and the salt swamp Tuz-Chöllu. The travellers, who lauded in warm terms the great courtesy of the Turkish authorities, laid down the section of the middle course of the Kyzyl-Irmak (Halys) which was not accurately known, and explored the countries in the south-west of Argæus, where caves are numerous. Here enormous pyramids have been completely carved out by denudation from volcanic ash. While Dr. Zimmerer drew a vivid picture of the spread of our knowledge of Asia Minor, and of the part Germans have taken in this enterprise, Herr Oberhummer described the incidents of the journey.

The second sitting of the Congress is set apart for the discussion of the teaching of geography. Dr. Fischer (Berlin) made a statement which gave no very cheerful

picture of the position of geography in the higher schools of Prussia, or, indeed, in the schools of other parts of Germany. There is no doubt that the new scheme of 1892 will give a check to the healthy development which geographical education entered on in 1880. Besides the fact that the weekly lessons in geography in the upper classes have been curtailed, a greater evil lies in the practice of the heads of educational institutions to intrust the teaching of geography to masters who have never studied the subject at the university, or submitted their knowledge of this branch of learning to the test of an examination. Dr. Fischer gave ample proof of this from statistics relating to the numerous schools of Berlin. Being convinced that the higher school boards are not fully acquainted with this untoward state of matters, or do not properly realise its consequences, the Geographical Congress resolved that Dr. Fischer's paper should be sent to all the High schools of Germany.

Professor W. Sievers (Giessen) then called attention to the educational tours for students that he has organised. They are each to last fourteen to sixteen days, and (1) the coast lands of the North Sea are to be visited ; (2) the central German mountains ; and (3) the Alps. The Governments are to be requested to bear part of the expenses. The discussion which followed showed that similar tours on a smaller scale, under the guidance of professors of geography, are in vogue at several universities, and their usefulness was unanimously recognised.

Professor J. Palacky of Prague spoke of the formation of herbariums for the purpose of instruction in botanical geography, independently of the large collections existing in the universities.

The third sitting, on April 22nd, was devoted to the physics of the Earth, and to earthquakes and Earth magnetism in particular. Professor Gerland, who is now director of an earthquake station in Strasbourg, gave a lucid exposition of the present condition of earthquake research, of the methods of observation, and, in particular, of the classification of the phenomena, distinguishing between simple movements of the surface, such as tremors and pulsations, which are due to atmospheric changes, and those disturbances which have their origin in the depths of the Earth's crust. Professor Gerland maintained the view that the source of these earthquakes must be sought for at the level where the core of the earth passes from a gaseous into a liquid or solid state, while in the following discussion, Professor Supan of Gotha, and Dr. Maas of Berlin, put in a claim for tectonic earthquakes, produced by relative movements of portions of the Earth's crust. Professor Supan in another address regretted the want of good observations of earthquake phenomena in Germany, and of an adequate organisation, which exists only in South-West Germany. As a model of publications, he instanced the Japanese Earthquake Catalogue, compiled by John Milne, for the years 1885-92. The discussion was highly suggestive and interesting. It was resolved to approach the German Governments with a recommendation for a system of observation throughout Germany.

The experts in Earth magnetism present were Dr. Adolph Schmidt (Gotha), Dr. August Schmidt (Stuttgart), and Dr. Neumayer (Hamburg). The first-named gave an address on the surface of distribution of magnetic force, as it may be deduced from the still incomplete observations. Apart from easily identified areas of disturbance, this surface is uniform, extending under the (mathematical) surface of the Earth at no great, but somewhat varying, depths. This points to general causes and not simply local ones. But all the observations do not at present lead to any positive results as regards the origin of the phenomenon. Dr. Naumann of Munich then demonstrated, with the assistance of large maps, the frequent coincidence of tectonic and magnetic disturbances, especially in England, France, and Japan, and energetically combated the notion that permanent disturbances were due to large iron deposits in the depths of the Earth, referring to the recent

researches into the magnetism of rocks, which late investigators had proved to be a purely superficial phenomenon.

With equal energy the fourth sitting, on April 23rd, addressed itself to the consideration of biogeographical questions. Professor Semon of Jena, who had been engaged in zoological researches in Australia, described in general outline the connection of the fauna with the geological history of the continent. Everything indicates a very long separation between East and West Australia, which probably were only temporarily connected in the south by a narrow isthmus. Professor Schneider of Dresden made known the results of ten years' work on the fauna of the small island of Borkum, with its astonishing wealth of organisms (2850 species), and traced with great ability the origin of certain forms, showing by what means they had been transported to Borkum.

Treating the subject rather from an anthropogeographical standpoint, Dr. Ed. Hahn of Lübeck described transport animals in their distribution and dependence on geographical conditions, his lecture forming a sequel to his excellent and suggestive work *Die Haustiere und ihre Beziehungen zur Wirthschaft des Menschens* (Berlin, 1896). In the discussion, Professor Brackebusch communicated his experience of many years with mules in Argentina, and Dr. Hans Meyer spoke of the possibility of training Masai oxen in East Africa as beasts of burden.

The last sitting, on the afternoon of April 23rd, was occupied by the geologist, Johann Walther of Jena, who depicted the scenery of Thuringia as dependent on the geological structure, and exhibited an excellent tectonic model of the Thuringian forest. Lastly, Dr. Peucker (Vienna) demonstrated with the help of large wall-pictures the effect of the shadow of mountains on the heating of individual points of the Earth's surface. Here we have quite a new attempt to reduce to figures the effect of climatic exposure, and to calculate the loss of direct radiation caused by the interposition of mountains on the east, west, or south.

Taking into consideration the communications as a whole, and the character of the discussions, we may say that the meeting in Jena was in a high degree stimulating and successful. On the friendly reception of the geographers in Jena, and on the festivities, we will not dwell here. They surpassed all expectations. Breslau was chosen as the next place of meeting. Should the seventh International Geographical Congress meet in 1899 in Berlin, the German Congress will be postponed till 1900 ; otherwise it will be held in 1899.

The Climate of the Schneekoppe.—Details of the observations recorded at this high-level station (5259 feet above sea-level) since July 1st, 1880, are given in the *Geographische Zeitschrift*, Jahrg. iii. Heft 4. The mean temperature for the period was almost exactly 32° F. (32·4°), which is about the same as that of Haparanda in Sweden at 66° N. lat. The coldest month was February, with a mean for the period of 18·9°, and the warmest July, with 48·2°, while the extreme monthly means were 7° in February 1895, and 52·3° in August 1892. The greatest heat recorded was 78·6° (August 1892), and the absolute minimum 18·6° (January 1894). The fall of temperature from the level country of Silesia to the highest point of the Riesengebirge was, on an average during the year, 0·94° in 300 feet. The fall is slowest in winter (0·66° in January), and most rapid in early summer (1·12 in June). As on other mountains the precipitation increases considerably at great heights. While in the low country it amounts to only 24 to 27 inches in the year, on the Schneekoppe it is no less than 46·6 inches, and yet this summit appears to rise above the zone of maximum fall, for still greater quantities are recorded at lower elevations in the neighbourhood, the maximum, 63·8 inches, being recorded at Siebengründe, 3025 feet above sea-level. The fall

on the Schneekoppe is far more abundant in summer than in winter, the quantities being in the ratio 2 : 1. As a rule snow covers the summit from October 10th to the end of May, or for about 230 days. It attains a maximum depth of fully eight feet, or about six times that of the snow on the low country during an unusually snowy winter.

ASIA.

Population of Siberia.—From the police lists of 1895 it appears that the total population is 7·2 millions, of whom 4·5 millions are Russians. Western Siberia (Governments of Tomsk and Tobolsk) is the most populous, containing three million inhabitants, of whom ninety per cent. are Russians. Next comes the General Government of the steppe, with 1·9 millions, among whom Kirghiz and other Central Asiatic tribes largely predominate. In East Siberia, with 1·2 millions, the Russian element preponderates in the Governments of Yeniseisk and Irkutsk, while in the Yakut district there are only 18,000 Russians to 254,000 natives. The most thinly peopled country is the General Government of the Amur, with 913,000 inhabitants. The non-Russians, consisting of natives, Manchus, Chinese, Coreans, etc., number 280,000. In Saghalin are 25,000 Russians. There are seventeen towns of more than 10,000 inhabitants, Tomsk and Irkutsk, with 50,000 each, heading the list; and thirteen more contain 5000 inhabitants and upwards. The urban population is chiefly Russian; Central Asiatic races are found only in the south-east of the steppe, while in Khabarovka and Vladivostok East Asiatics (Coreans, Chinese, and Japanese) are more numerous than the Russians.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xxiv. No. 3.

The Maldivh Islands.—Herr C. W. Rosset has contributed a long description of this group to the *Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xxxix., Nos. 8 and 9. It extends from 7° 6′ N. lat. to 0° 42′ S. lat., and from 72° 33′ to 73° 44′ E. long., covering, therefore, an area of about four hundred and seventy nautical miles in length by seventy in breadth. The islands are grouped together into atolls, of which there are more than twenty, though for administrative purposes they are divided into thirteen groups. In the middle of the chain the atolls form a double row, with ten to twenty miles of water between. Barrier reefs surround the southern atolls and protect them from the surf and violent storms by which they are often visited; but north of 3° 31′ these reefs are absent. The slope of the reefs on the sea side is very steep, anchorage being often sought in vain at a depth of 220 fathoms close to the reefs. Some of the channels running between the atolls are deep and safe, while others cannot easily be navigated, except by steamers, owing to the currents which run strongly east or west according to the season. By night only the four largest channels can be navigated without danger, namely, the Kardiva or Five-Degree Channel; the Veimandu, between the atolls Kolumadulu and Haddummate; the One-and-Half Degree channel, the broadest and safest of all; and the Equatorial channel, of little use to navigation because of the island Moloku that lies in the midst

The islands forming the atolls generally lie on the belt of coral reef; few lie within the belt. Some are round and some oval, and all are small, few exceeding five miles in length. As a rule they do not rise more than six or seven feet above the sea, so that the coco palms appear almost to grow out of the water. Among the natives the belief prevails that the islands are slowly disappearing, and that their number is being diminished by the continual attacks of the surf. The number has been variously given; the Sultan of the Maldivhs is styled "Lord of 12,000 Islands," but probably a countless number is simply meant.

The Lakadivh, Maldivh, and Chagos groups are built on the same chain of submarine mountains, and whereas the reefs of Ceylon are rising, those of the Maldivh and Lakadivh islands are sinking. One peculiarity of the Maldivhs is that the reefs do not form a continuous ring; but small islands, separated by channels, often more than a hundred in number, compose an atoll. Many of these islands are themselves ring-shaped, enclosing lagoons which are connected with the open sea by two entrances, and have a depth of three to nine fathoms. Occasionally the larger atolls may have been dismembered by violent hurricanes; the channel which intersects the Malosmadulu atoll is said to have been thus formed. Nearly all the inhabited islets have fresh drinkable water.

The name Maldivh is probably derived from Malé, the principal island and residence of the Sultan, and *diva*, corrupted from the Arabic *dwita* = island. Malé may be derived either from the Arabic *mal* = wealth, or the Hindustani *aahal* = palace. The first Western traveller who visited them was Ibn Batuta (1325-1354), who spent eighteen months on the Maldivhs, and rose to the rank of a minister. Pyrard de Laval was wrecked on the Malosmadulu atoll in 1602, and was held captive by the natives for five years, when he was released by the Nawab of Bengal, who, with sixteen vessels, came against the islands. In 1834-36 the Indian Government sent Captain Moresby, and Lieutenants Christopher, Powell, and Young, to make a geographical and commercial investigation of the group, and their observations, published in reports of the Bombay Geographical Society, are of great value to naturalists and historians, though more than fifty years have passed since their visit.

It is difficult, perhaps impossible, to discover the origin of the Maldivh race, but no doubt the group, as well as Minicoy to the north of it, was peopled from Ceylon, and this view is confirmed by the affinity of the Maldivh and Sinhalese dialects. Owing to intercourse with the continent, especially Malabar, to Arab influence, and the introduction from time to time of African slaves, the original type has been greatly modified, especially on the northern atolls nearer to the mainland. If the Sinhalese were the first colonists, their arrival cannot be placed later than the Christian era, when Ceylon was a powerful monarchy, for the dialect spoken on the Maldivhs has most resemblance to the ancient Sinhalese. It may be, however, that Ceylon and the Maldivhs were colonised contemporaneously several centuries before the Christian era. As early as the eighth century Mohammedans established settlements on the Indian coasts, and as the Maldivhs lay in the direct route from Yemen to China, they naturally came under the influence of the Arabs, so that the inhabitants were converted to Islamism during the twelfth century. Probably the islands were subject to a Mohammedan kingdom on the coast of the mainland, and their dependence may have lasted into the fourteenth or fifteenth century.

The Arabs were followed by the Portuguese, who early in the sixteenth century established a feeble protectorate over the islands. In the seventeenth and eighteenth centuries the Dutch were the predominant European nation in the East, and they established friendly relations with the Sultan of the Maldivhs. Lastly, in 1796, Ceylon came into the possession of Great Britain, and it is now the custom, as it was during the Dutch supremacy, for the Sultan to send a present annually to the Governor of Ceylon, and petition for a continuance of the protection of Great Britain.

The climate of the Maldivhs is by no means disagreeable to Europeans. The temperature is not very high; in December, January, and February it varies from 79° to 84° F., and falls to 75° in the night; while in April it ranges from 86° to 90° in the day, and falls to 80° at night. Owing to the sea breeze the heat is not

particularly oppressive. Yet a sojourn on the islands is prejudicial to the health of Europeans in consequence of the exhalations from the lagoons and swamps, and the dense jungles which the natives allow to grow up close around their dwellings, shutting them off from the fresh and purifying sea breezes. Even the natives themselves are subject to the diseases produced by mephitic exhalations, especially intermittent fever and dysentery; and they are frequently attacked by measles. Various estimates have been given of the number of the inhabitants —from 30,000 to 200,000; probably the former number is nearest to the actual. In former times the population was much larger, and now the improvement introduced into their mode of living by contact with the outer world may check the decay of the race.

The Malé atoll, in which the residence of the Sultan is situated, is divided into two by a deep channel in which there is no anchorage, so that it might be considered as two distinct atolls; but the natives include both under the same name. The northern atoll is irregular in shape, running out into points at the north, south, and east. Its length is about thirty miles and breadth about twenty-two. It contains some fifty islands, of which about ten are inhabited. The water within the atoll has an average depth of thirty-eight fathoms, but the sandbanks and coral reefs are so numerous that boats can navigate the lagoon only in the daytime, and with great care. The entrances are numerous on all sides. At the south of this northern atoll lies Malé, the Sultan's residence, in lat. 4° 10′ N. and long. 73° 30′ E. It is a low, oval island about a mile long and three-quarters broad. Barrier reefs, encircling it on the southern side, leave entrances for vessels in the north. Here a bank of coral raised three feet above the water, and roughly repaired from time to time, shelters vessels from the storms of the monsoon. At one time the island must have been a formidable fortress. The remains of a wall, still in parts capable of defence, with bastions, etc., are visible. The houses of the town are built of jungle wood and straw, and are usually surrounded by gardens containing fruit-trees and flowers. A hedge over six feet high separates the houses from the street. Now there is only one house on the island built of stone and mortar, though in Pyrard's time all the well-to-do men lived in houses of coral stone. Malé has two to three thousand inhabitants, including traders, fishermen, distillers, and cowrie gatherers. The whole export trade of the group passes through Malé, and pays fixed custom duties to the Sultan.

The Maldivh islanders are at first somewhat reserved with strangers, but when they come to know them they show themselves open-hearted, bold, and possessed of insatiable curiosity. They are honest and amiable, but, having few needs, are supine and lazy. They have often shown their philanthropy to shipwrecked men, tending them with every possible care, and landing them in their own vessels on Ceylon and the coast of India. In the few crafts they exercise they exhibit skill and taste, and they are said to be good sailors.

The botany and zoology of the Maldivhs has not been investigated, but it is not to be expected that they contain any special fauna and flora. The only mammal is the coco rat, and the birds are those of Ceylon and India. At a short distance the islands appear to be covered with a thick vegetation of coco palms and *Pandanus*, the fine coral sand being peculiarly favourable for their growth. The coco palm is invaluable to the native, providing him with a variety of foods, material for his household utensils, and wood for his huts and boats. Kadu wood is not durable enough for building, and is formed only into rafts. The Duburi-tree (*Calophyllum inophyllum*) is employed in the internal decoration of the houses, and also possesses a certain value owing to its resin and the medicinal oil obtained from its seeds. Banian and bread-fruit trees complete the list.

AFRICA.

Sunshine at Kimberley, South Africa.—Tables of sunshine recorded at the Meteorological Observatory maintained by the De Beers Company at Kenilworth, near Kimberley, have been sent by Mr. J. R. Sutton to *Symons's Meteor. Mag.*, March 1897. The instrument is a Jordan photographic recorder, by Negretti and Zambra, of the twin semi-cylinder pattern. No correction has been made for refraction, or for the want of actinic power when the sun is low and the atmosphere dusty. The number of hours was 3266¾ in 1894, 3337 in 1895, and 3169½ in 1896. The percentages of the possible were 74, 76, and 72. If these figures be compared with those in Mr. Dickson's article (vol. ix. p. 393), and on the accompanying map, it will be seen how much more favoured Kimberley is than any place in the British Isles. The number of hours is, indeed, much in excess of the maximum in Europe, at Madrid (vol. xii. p. 535). The days without sunshine numbered seven in 1894, three in 1895, and four in 1896. Yet the rainfall is not remarkably small, having been 24·51 inches in 1894, and 15·60, 21·07 inches in each of the other years, while the numbers of the days on which rain fell were 98, 100, and 115. July is a dry month, while the wettest are December and January. Considerable variations are shown by the tables, which will no doubt not appear in tables for a longer period.

The Lualaba and Luapula.—Mohun and Hinde followed the Congo upwards from Nyangwe to the mouth of the Lukuga, and Delcommune and Briart to Ankolo, while Bia, Franqui, and Cornet descended the Lualaba from its source-region, through the lake district, to the mouth of the Lovoi. Earlier expeditions traced the course of the Luapula from Lake Moero to the narrows of Kwikuru in 8° S. lat. There remained, therefore, two sections unexplored—on the Lualaba from the Lovoi to Ankolo, about 120 miles, and from Ankolo to Kwikuru on the Luapula, about 150 miles in length. Both sections have been explored by Lieut. Brasseur, who left the Lofoi station in Katanga on June 1st, 1896, and reached the Lualaba at Shimaloa (9° 15′ S. lat.), where Le Marinel crossed it in 1891. The river was here 150 yards broad and 10 feet deep. As he travelled in the dry season, Lieut. Brasseur was able to investigate thoroughly the series of lakes lying to the north; between Shimaloa and the mouth of the Lovoi he found the Kaybayba, Kabwe, Kabele, Upemba, Kaponda, Mutenda, and Kissala lakes, the Kaybayba and Kaponda being new discoveries. Farther down the river he found two more, the Lubambo and Kalomba, on the right bank, besides the Patobwe pool, which is only an expansion of the river-bed. The Lualaba is navigable for the whole distance of 250 miles from Shimaloa to Ankolo, and has only a slight fall, from 2130 to 1700 feet above sea-level. The Mitumba mountains on the right, and ranges of hills on the left, confine the rich and densely peopled valley within rather narrow limits. The natives of the country call the river Kamolondo.

Like the Lualaba, the Luapula also forces its way through the Mitumba mountains, and is obstructed by rapids for long distances. It is skirted by wild, steep mountains as far as 7° 50′ S. lat. The fall is about 1230 feet in its course of 270 miles.

In a not very remote geological period, the whole Urua country between Ankolo and the Mitumba mountains was covered by a large lake, of which the chain of lakes along the Lualaba is a residue. The waters were then dammed up by a barrier, which Mohun discovered north of the mouth of the Lukuga, in lat. 5° 10′ S., and which the Congo now traverses by a gorge Mohun named the Porte d'Enfer.—*Globus*, Bd. lxxxi. No. 18.

AMERICA.

The Danish Expedition to East Greenland in 1891-92.—Herr N. Hartz of Copenhagen, a member of the above expedition, contributes a report of the work to *Petermanns Mitt.*, Bd. xliii. No. 4. A full account has been published in the *Meddelelser om Grönland*. The chief object of the expedition, namely, the exploration of the unknown east coast from Scoresby Sound down to Angmagsalik, visited by G. Holm in 1884-85, was unfortunately not accomplished, but the many and varied investigations carried out, especially in Scoresby Sound, render this expedition notable in the long series of Arctic voyages.

Under the leadership of Lieutenants Ryder and Vedel, the expedition left Copenhagen on board the *Hekla* on June 7th, 1891. On the 19th, the proximity of ice was marked by the change of temperature of the surface water. After gradually falling from 56° to 43°, it then fell much more rapidly, the thermometer marking 42° at midnight, and only 35° at 8 o'clock on the following evening. At the same time, the air temperature fell from 44° to 38°, and the weather became raw and misty. On the 20th, the edge of the pack was reached; with many indentations and promontories, it ran in general north and south. Clay and diatoms were eagerly collected from the holes in the ice. A sounding of 927 fathoms was taken on the 22nd, and the bottom found to be fine clay.

The Beerenberg on Jan Mayen was sighted on June 24th at a distance of 115 miles. As a rule, the edge of the pack has moved to the west of the island by the beginning of May, but this year it was still ninety miles on the eastern side as late as the end of June. Soundings were taken where, according to Mohn's bathymetrical chart, a bank extends south-south-westwards from the southern extremity of Jan Mayen, and considerable depths (310 and 790 fathoms) were found within Mohn's contours. After sailing some days through the ice, a small channel in the solid ice was discovered leading to water where the ice was much scattered, and which seemed to extend to the Pendulum Islands. The Scottish and Norwegian sealers affirm that a bay is usually to be found in the ice between 73° and 76° N. lat., and such the Danish expedition found to be the case.

Skirting the coast southwards, the *Hekla* reached Hold with Hope in 73° 30′ N. lat., where three musk-oxen were shot, and traces of lemmings and reindeer were noticed. As the land-ice stretched unbroken from Cape Broer Ruys, the easternmost promontory of Hold with Hope Land, to a little east of Bontekoe Island, the excursion to Franz Josef fiord had to be given up. From lat. 73° to 72° the coast was in some measure surveyed, in spite of rough weather, which lasted several days. The land is much indented by sounds, fiords, and valleys, and sometimes it was difficult to bring the observations into agreement with Scoresby's map. The soundings, which were taken at a distance of thirty-five to forty miles from the coast, showed a regular bottom at depths varying from 110 to 150 fathoms. The ground was fine grey clay, with numerous stones, many of them large.

On August 2nd the expedition entered Scoresby Sound, Cape Stewart having been chosen for winter quarters. The fiord presented a charming and beautiful appearance; on the southern side it is begirt by precipitous walls of basalt 2000 to 3000 feet high and crowned by glaciers. Westwards, no land was visible, the fiord extending to the horizon in this direction, while northwards lay the wild, jagged, gneiss country of the Liverpool Coast. No ice was met with at the entrance of the fiord, and therefore the party expected to reach Cape Stewart without delay; but, as they steamed towards it, one iceberg after another appeared, and at last it became evident that the *Hekla* could not reach its goal. Accordingly,

a landing was effected in boats on August 3rd, the *Hekla* remaining in the fiord. At Cape Stewart everything was found just as Scoresby described it seventy years ago; but, the shore not being suitable for landing stores, a search was made, and a lead of water discovered by which the *Hekla* could enter Hurry Inlet. This proved to be only a deep bay separating the Liverpool Coast from the geologically different Jameson Land. The fauna was abundant and the vegetation luxuriant. The *Hekla* also sailed farther up the sound, passing large icebergs 100 feet high, and discovered an excellent harbour in Denmark Island, which was ultimately chosen for winter quarters. The icebergs of Hall Inlet deserve mention; they have the well-known Antarctic form—flat at the top and with vertical sides. One of them had the following (estimated) dimensions: length and breadth 5 furlongs, average height 210 feet.

The first sledge expedition started on May 27th, 1892, with the temperature at −35° F., under the command of Ryder and Vedel. It visited Rote Insel, and, passing through the Roter fiord, mapped the Schneehuhn and Hasen fiords. The second excursion was made to the Föhn and West fiords, the third to the Gänse fiord, and the fourth to Gänseland. On July 20th, the first great fissure was seen in the ice of the sound, and on August 8th the *Hekla* was able to start on her homeward voyage.

The scientific observations have been reported on by various specialists. Meteorological records were kept for ten and a half months. During the six months from November to April the mean temperature was from +1° to −17·5°; in June and July it was 34° and 40° respectively, and in the latter month the thermometer only once sank below freezing-point. The absolute maximum was 59·4° on July 13th, and the absolute minimum −52·2° on March 7th. Long periods of extreme cold were rare. Winds also were seldom experienced; the most frequent was a *Föhn* wind blowing north-north-west. There was precipitation, almost wholly snow, on 131 out of the 318 days of observation. Great changes of temperature were common, the thermometer rising 5½° in an hour, and sometimes as much as 9°.

As regards sea temperature, Lieut. Ryder reports that as a rule it is above freezing-point east of Jan Mayen and below to the west of the island. The year of the expedition it was below freezing-point to a distance of 140 miles from the coast. On the east coast of Greenland it usually ranges from freezing-point to +4°, and seldom sinks below 32°. In Scoresby Sound the surface temperature rose as high as 49·5°. The highest salinity, 3·53 per cent., was found in crossing the Gulf Stream between the Færoes and Iceland. Along the east coast of Greenland it varies from 2·5 to 3.

The deep-sea researches supplement those of the Norwegian North Sea expedition. It appears that the temperature conditions in the western part of the North Sea are by no means so regular and so simple as has been assumed. A singular discovery is that of a layer of water on the east coast of Greenland, with temperatures of from 31° to 33° and a salinity of 3·49 per cent. It lies at a depth of 110 to 220 fathoms, and probably extends to a distance of ninety miles from the coast. Probably it is a continuation of the warm current along the west coast of Spitzbergen. In Scoresby Sound the bottom slopes gently down from the shore of Jameson Land, but off Milne Land 220 fathoms was sounded at a short distance from the shore. The surface water is comparatively warm (42° to 46°) and contains little salt. The temperature falls to a minimum of 29·1° to 28·6° at a depth of fifty-one fathoms, and then rises to the bottom. The maximum salinity is found in the warm bottom layer and at a depth of about seventy-six fathoms. The warm bottom water Lieut. Ryder believes comes from the outer sea, the current already

mentioned entering the sound by a deep ditch or crossing the entrance under certain conditions.

We must pass over the notices of the botanical, zoological, and other collections, but may spare a few lines to the geology of the region. At Hold with Hope the land is entirely basalt, and in Scoresby Sound gneiss and basalt are the most abundant rocks. But the little Rote Island and the land towards the north-west of it is formed of a red sedimentary conglomerate of unknown age, rich in lime and without fossils. Near Cape Leslie, on the east coast of Milne Land, is a coarse greyish yellow, or reddish, sandstone, likewise without fossils and therefore of undetermined age. Very interesting are the rocks of Jameson Land, which are built up of Rhætic clay schists, Jurassic limestone, sandstone, and basalt. The strata dip at an angle of 6° towards S. 50° W. Numerous signs of a post-Glacial upheaval of the land were noticed. Along the coast a reef seems to run, which is assumed to have been the terminal moraine of the inland ice, when it had reached its maximum extension.

Mr. A. P. Low in Labrador.—During the summer of 1896 Mr. Low crossed the north-western part of the peninsula, from Richmond Gulf, on Hudson Bay, to Fort Chimo on Ungava Bay. After travelling twenty-five miles or a little more, Mr. Low reached a series of small lakes lying on the inland plateau 800 feet above sea-level. A week was spent in navigating these lakes and crossing the portages between them, and then, on July 11th, Clearwater lake was reached. Thus far the country had been explored by the same traveller in 1888. The lake is about thirty-five miles long, with a maximum breadth of eighteen miles. Its banks are irregular, and numerous islands stud its surface. In the neighbourhood rounded hills of granite and gneiss rise to a relative height 100 to 400 feet. A portage of fourteen miles leads to Seal lake, which takes its name from the number of seals living in it; they are either the true harbour seal (*Phoca vitulina*, L.) or a variety of the same species. The lake is about fifty miles long and varies in breadth from one to five miles, and lies in a country similar in character to that surrounding Clearwater lake. On August 4th Mr. Low followed a small stream flowing into the north-east of the lake, and passing through four small lakes crossed the height of land 900 feet above sea-level. Descending into the drainage basin of rivers flowing into Ungava Bay, he came to a narrow lake, seven miles long, out of which flows the Natwakanie or Stillwater branch of the Koksoak river. In the first fifty-five miles the river forms sixty-four rapids. It is joined by several streams from the north and by one considerable tributary just below the rapids. Below the confluence the current slackens, and nine miles farther the stream enters Stillwater lake, fifteen miles long by a quarter of a mile to four miles in width. The country around is very rugged and barren. The valley is bounded by hills that rise 100 to 800 feet above the river. The Kenogami branch, flowing from the south, has at least twice the volume of the stream Mr. Low and his party descended; it is encumbered by rapids for a distance, according to the Indians, of thirty miles. Below the confluence of the Kaniapiskow the river widens out to about a mile across, and thence to the mouth, ninety-five miles below, it varies from one to two and a half miles.

At Fort Chimo Mr. Low took passage on a Hudson Bay Company's steamer going down the east coast. He made a large collection of plants, and obtained some birds' eggs, small mammals, insects, etc. A large area of valuable iron-bearing rocks was discovered, forming a continuation of the Cambrian area of the Kaniapiskow.—*Summary Report of the Geological Survey Department*, 1896.

West Kootenay.—Until eight or nine years ago the extensive mountainous

country south of the Canadian Pacific railway was known only to a few Indians and hunters. Many years ago men in the Hudson Bay Company's employment discovered silver-lead ore on the east of Kootenay lake, but it was not till 1890-91 that this and other silver veins began to attract mining men to the district. In 1895 large quantities of auriferous deposits were also found at Le Roi and War Eagle, and the following year there was a great influx of agents of capitalists and miners. At present the output does not appear large, for the country has been only recently opened up, and the work has been carried on under difficulties and with insufficient capital, so that no single mine has been brought into full working order.

In a *Report on the Slocan, Nelson and Ainsworth Mining District*, Mr. W. A. Carlyle gives, among other information, some details chiefly collected from the Geological Survey reports on the geology of the country. A provisional map is to be issued this year by Mr. M'Connell and Mr. J. M'Evoy. Granites and granitic rocks extend over a large part of West Kootenay, covering the basin of the Lower Arrow lake, and thence stretching eastward to Queen's bay on Kootenay lake, and also appearing in smaller areas and dykes. Probably they belong to two, or perhaps three, distinct periods. Those which are supposed to be the oldest have been found in some places underlying the lowest beds of the gneisses and mica-schists of the Shuswap series, and, indeed, in hand specimens are often scarcely distinguishable from the homogeneous gneisses of the latter. They are generally fine-grained, and are believed to be for the most part muscovite-biotite granite, though as yet it cannot be confidently asserted that this is their characteristic composition. The granites, which occupy by far the largest area, however, are of coarse texture, and may be described generally as hornblende granites passing occasionally into mica-syenite. They are evidently intrusive and of later date than the stratified rocks, which are altered at the contacts. The later eruptive granite rocks occupy the western part of the region from about the north end of Lower Arrow lake southwards to Trail Creek, and east to within a few miles of Kootenay lake, covering an unbroken area of fully two thousand square miles. Diorites, diabase, and uralite porphyrites, still younger than the granites, occupy a considerable area in the Trail Creek country, and are important, as they contain the principal lodes of that district. Possibly the porphyritic rocks so abundant in the Toad mountain region belong to this group.

Of the series of stratified rocks the lowest is the Shuswap, which consists of gneisses, mica-schists, calc-schists, diorites, crystalline limestones, and nearly pure quartzites. Next comes the Nisconlith series of dark calc-schist, with occasional bands of limestone and green schists. The Kaslo schists are greenish and probably mostly diabase, interbedded with some slates and limestones. The uppermost formation is the Slocan slates, or a series of dark shales and slates with limestones and calcareous quartzites. The thickness of these stratified rocks has been determined by Dr. Dawson to be 23,200 feet. The Shuswap series is probably Archæan, while the others are evidently Palæozoic, and may belong to various systems, including the Carboniferous, and extending down to the Lower Cambrian.

The principal geological boundary in the district is the irregular line separating the granite area from the slates on the northern side. Leaving Slocan lake at Four-Mile creek, it crosses the outlet of the Kootenay lake four miles from its head. The upper series of stratified rocks is largely developed in the Slocan country. The Shuswap series occupies the basin of Kootenay lake for a distance of at least forty miles south of Kaslo, bordering both shores in bands a mile or two wide. The dip is almost invariably west. East of the lake the series is

developed on a grand scale, extending up to the summit of the range, while west of Ainsworth all the series are represented. The granite is extensive in the Nelson Division, but a band of green schists strikes eastward from the Kootenay river across Toad mountain and down the Salmon river. The schists on Toad mountain are believed by Dr. Dawson to be stratified volcanic material of Palæozoic age.

The above is merely a very general sketch of the geology as at present known, for much work remains to be done in this country, and many conclusions are to a large extent conjectural.

Climate of the United States, 1896. The annual summary of the *Monthly Weather Review* states that the mean annual temperature was above the normal at nearly all stations, the largest departures occurring in the middle slope and the west Gulf States. It was below the normal on the north Pacific coast and in parts of New England. The absolute maximum for the whole country, 117°, was registered at Yuma. The lowest readings were recorded at Havre (−33°), Lander (−31°), and Northfield (−30°). The regions of large annual ranges of temperature were, as usual, the north, middle, and south Pacific slopes and the Missouri valley. The accumulated departures of average monthly temperatures show that there was a steady diminution in the deficit with which the year began in the Atlantic and Gulf States, generally turning into a surplus before the end of the year, while in other portions of the country an initial excess of temperature generally increased steadily until the close. The greatest precipitation occurred at Tatoosh Island (100·8 inches), Astoria (94·8), Fort Canby (78·6), while the least fell at Yuma (2·6), San Diego (8·7), and El Paso (9·3). An annual fall of above sixty inches was measured on small portions of the coast of Florida and Alabama, Nova Scotia and Newfoundland, and all along the coasts of Oregon and Washington, while the precipitation was less than ten inches in Southern California, Nevada, Utah, and Colorado, western New Mexico and northern Arizona. A steadily increasing deficit prevailed over the Atlantic States, Ohio valley, and the lake region, but elsewhere there was a slight excess.

Cook's Inlet, Alaska. — A party of prospectors ascended the large and rapid Sushitna river last summer, and one of them, Mr. W. A. Dickey, has written an account of the journey. One interesting discovery is that there is a break in the Alaskan mountains, which have been supposed to carry on the line of elevation of the Rocky mountains uninterruptedly into the Alaska peninsula. From Mount Sushitna on Cook's Inlet there are no mountains for a distance of 150 to 200 miles inland. Broad level country heavily timbered with spruce and birch stretches westward as far as can be seen from the low hills east of the river. North of this break in the Alaska range was seen a mighty mountain much higher than the surrounding peaks. Some of the party estimated its height at 20,000 feet, but this may be an exaggeration. The U.S. Geological Survey will probably send out a party this year to survey this little-known region, which is beginning to attract the attention of gold-seekers.—*Bull. of the Am. Geogr. Soc.*, vol. xxix. No. 1.

The Indians of Mexico.—Herr Carl Lumholtz returned to the city of Mexico just before Christmas after a journey of two and a half years among the uncivilised tribes of the Republic. One of the most interesting tribes he visited is that of the Huicholes, who to the number of 4000 dwell in the northern part of the State of Jalisco among the mountains. They are exceedingly distrustful of strangers, and owing to their enmity to white men Herr Lumholtz was often in danger of his life. They still preserve their heathen temples in almost inaccessible mountainous

country. These are curious round structures of firwood thatched with straw Each god has its separate temple, and Lumholtz counted forty-seven of them, the chief being Tatevalo, the god of fire. The Huicholes are well proportioned; their faces are of pronounced Indian type, and their reddish-brown hair falls long and smooth over their shoulders. They wear a white mantle embroidered with wool in very elegant patterns, and the ornamentation of their girdles also exhibits great taste. The colour of the skin is reddish-brown, and the men are, in contrast to the Tarasco Indians, beardless.

The Tarascos live in Michoacan and other parts of Western Mexico. They are exceedingly superstitious and mistrustful. About 200,000 Tarascos now wander among the mountains of Michoacan. The Cora Indians in the Tepic territory are a warlike people, and in the time of the French invasion assisted the robber chief Lozada, who in fourteen years laid waste the town of Tepic and the whole country; but they are now few in number. Lumholtz reckons that there are still about 150,000 Aztecs scattered along the coast from Sinaloa southwards through Tepic, Jalisco, and Michoacan, and in the west of Mexico. They are a peaceful people, living by agriculture. Nominally Catholics, they secretly cleave to their old gods, and their religion is a mixture of superstition and the fear of God, of paganism and image-worship.—*Globus*, Bd. lxxi. No. 14.

MISCELLANEOUS.

Prince **Henri d'Orléans** has set out for Djibouti, whence he intends to enter Abyssinia and, if circumstances permit, cross the country towards the Upper Nile.

On May 18th **Mr. Andrée** left Gothenburg for Spitzbergen. His balloon has been enlarged so as to remain in the air for six weeks. Mr. Andrée will be accompanied by Mr. Knut Fränkel, a civil engineer, and will start on his voyage, if the winds be favourable, about June 20th.

According to the *Revue Scientifique*, April 10th, two Danish travellers, MM. Olifsen and Philipsen, have discovered a tribe of **dwarfs** on the plateaus of the Pamir. What is most singular is that their domestic animals are also of diminutive size, their ox being no larger than a European ass, and their ass as small as a dog. The severe climate and insufficient food are supposed to be the causes of their arrested development.

At a meeting of the Royal Geographical Society held on May 17th, Sir Clements Markham announced that the council had decided to organise a **British Expedition to the Antarctic**. An appeal will shortly be made for funds to equip the expedition on an adequate, but not an extravagant, scale. The Admiralty has promised to assist by the loan of instruments and by advice, and very probably the Government will make a grant towards the cost of the undertaking.

In connection with the Exhibition held this year in Brussels, an **International Colonial Congress** will be organised under the auspices of the Belgian Government and of the administration of the Congo State, and will meet on August 16th to 19th. Questions will be discussed bearing on colonisation from all points of view —the formation of colonies, their administration, means of transport, labour, etc. etc. All communications and applications for tickets (10 francs: ladies 5) should be addressed to Baron Lambert, Rue d'Egmont, 2, Brussels.

The programme of the **Summer School of Art and Science** has been issued. This year the meeting will be held from August 2nd to August 28th, but, as usual, students may attend for a fortnight only.

At these meetings an effort has been made to teach biological and social subjects on parallel lines, but it was not possible to render the parallelism between them very clear until the Outlook Tower, with its comprehensive and synthetic classification of the arts and sciences, was opened. Still the difficulty has not been entirely removed, and therefore at this year's meeting social subjects will be the more prominent, while in 1898 biology will receive the larger share of attention.

Inquiries should be addressed to Mr. T. R. Marr, Outlook Tower, Castlehill.

At the Italian Exhibition to be held in Turin from April to October, 1898, a section will be devoted to **Italian exploration**. It will be divided into two classes, the first dealing with exploration in past times up to the year 1888, and consisting of five categories, namely: The Expansion of Rome; The Mediæval Period down to the end of the Fourteenth Century; The Great Discoveries of the Fifteenth Century; The Sixteenth, Seventeenth, and Eighteenth Centuries; and The Present Century down to 1888. The second class will be devoted to recent exploration. Many maps, documents, etc., relating to early exploration are probably hidden in public and private libraries, and the Commission requests that librarians, geographers, and students will assist them in bringing these to light and in procuring the loan of such documents or of photographic reproductions. The president of the Section is Professor Guido Cora.

NEW BOOKS.

Industries and Wealth of Nations. By MICHAEL G. MULHALL, author of *The Dictionary of Statistics.* London: Longmans, Green, and Co., 1896. Pp. 451, and 32 Diagrams. *Price* 8*s.* 6*d.*

It is important that we should periodically compare the progress of our country in all its aspects with that of other countries. Nothing is more likely to help us in detecting blunders in our commercial and administrative methods. Nothing is more likely to convince us that we may be failing to avail ourselves of knowledge and experience acquired by our competitors in international commerce. Even at the present time there is a great tendency to keep working on the old lines, notwithstanding the advance of science, which has in many cases quite altered the conditions. Our merchants and politicians owe many serious blunders to ignorance of geographical knowledge that has been taken advantage of by other nations to their profit.

In the present volume Mr. Mulhall reviews the progress of the civilised world during the past sixty years, and reveals a development the most marvellous that history has ever witnessed. In a study of this development the first factor to be taken into account is, of course, population. Without population there can be no wealth. As Mr. Mulhall points out, "the immense territories watered by the Amazon are not at present worth more than sixpence an acre, because they are untenanted: on the other hand, the little island of Barbadoes, although inhabited by Negroes, is most valuable." The rapid development of wealth in the United States is mainly owing to the great immigration of an active working population. The next great factor of progress is the aiding power of mechanical energy—the enlisting of the giant forces of water, steam, and electricity to work for man—to drive our mills, to transport our products over land and sea, to send our communications round the world at lightning speed. These are the powers to which our increased development is mainly due.

After consideration of the factors of progress, Mr. Mulhall summarises the actual statistics of industries in the various countries—agriculture, fisheries, mines, manufactures, and commerce. To trace the growth of these industries is very instructive, and especially so when done comparatively. Finally, we have an interesting summary of the wealth resulting from our industries. We have here reproduced two of Mr. Mulhall's graphic diagrams. One shows the comparative wealth per inhabitant for the leading countries of the world. It reveals the fact that the English are the wealthiest people in the world, and that the Scotch come next, while the Russians, with their vast territories, are the poorest. The other interesting diagram illustrates the growth of commerce since 1860, and shows that the trade of the United Kingdom is still more than double that of any other country, though Germany, the United States, and France, have enlarged their trade in greater ratios.

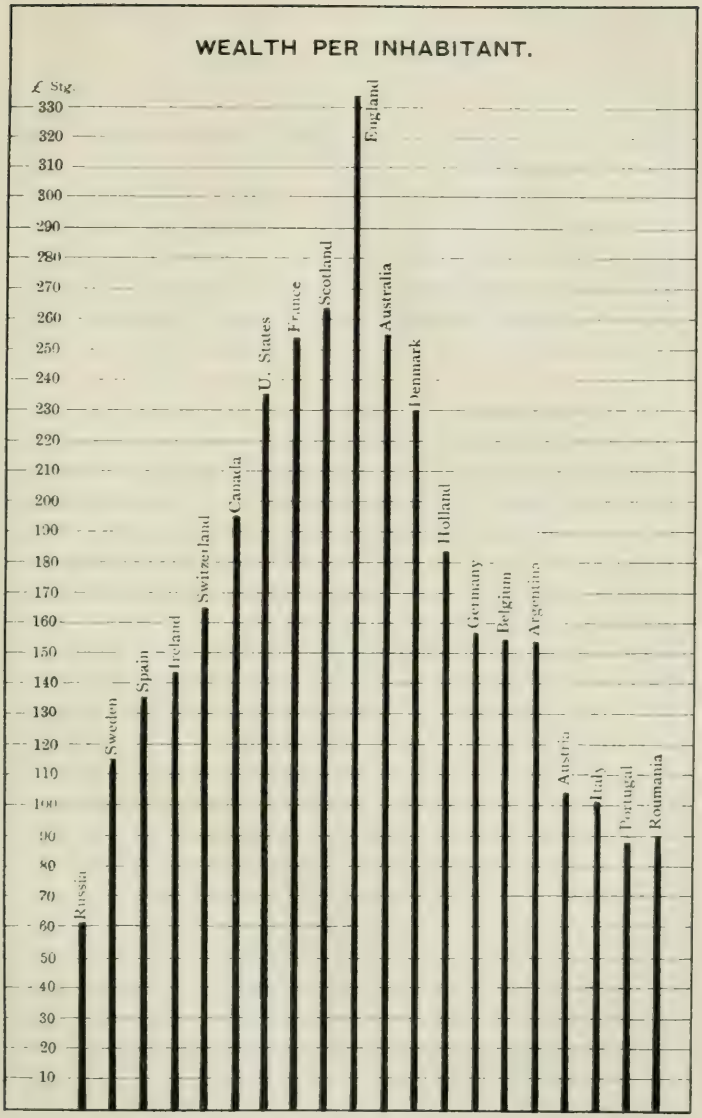
The Wealth and Progress of Nations is not only a notable work of the present time, but it will remain as a permanent record of the progress of the nineteenth century. It is a book which could only be produced by an enthusiast in his subject, and as such the author deserves all praise.

National Progress in the Queen's Reign, 1837-1897. By Michael G. Mulhall, author of *The Dictionary of Statistics*. London: George Routledge and Sons, Ltd., 1897. Pp. 114.

This little volume may almost be described as a summing-up of the hard facts set forth in the preceding work by the same author, but supplemented by some practical reflections. Mr. Mulhall has here traced in a somewhat more popular and descriptive manner the progress of the British Empire in our Queen's reign. Some of his conclusions and deductions are of special interest, and may help us to look with some profit at the darker side of our glorious progress of the past sixty years. In reviewing the condition of the masses, it is humiliating to realise that, at the headquarters of our boasted civilisation, "the inhabitants of the poorer quarters of London are condemned to a mode of life far more degraded and uncivilised than that of any tribe of Western Africa." When we place such facts beside Mr. Mulhall's statement that "every able-bodied male or female settler is valued in the British colonies at £200 sterling," it is plain that the study of geographical demography requires attention.

British India. By R. W. Frazer, LL.B., I.C.S. (Retired), Lecturer in Telegu and Tamil, University College and Imperial Institute, etc. London: T. Fisher Unwin; New York: G P. Putnam's Sons, 1896. Pp. ix + 399. *Price 5s.*

This brief history of British India, which has been prepared for the series of the Story of the Nations, gives a really very good, if necessarily condensed, narrative of the rise and development of the British Empire in India. The main outlines are clearly sketched; the relations of the determining factors are made distinctly prominent; and the whole story is told by the author with a warm interest in his subject which cannot fail to carry the reader with him. He has rightly given his attention to the main factors which have influenced the progress of events rather than to the details of military operations. The history of commerce between the East and the West, the struggles between Western nations for the command of the Eastern trade, the decay of the Moghul empire, the vigorous policy of Clive, Hastings, and Wellesley, all find appropriate recognition and sufficiently full exposition. The military element also, if it has been kept subordinate, has not been neglected. In fact, without some account of military achievements, the story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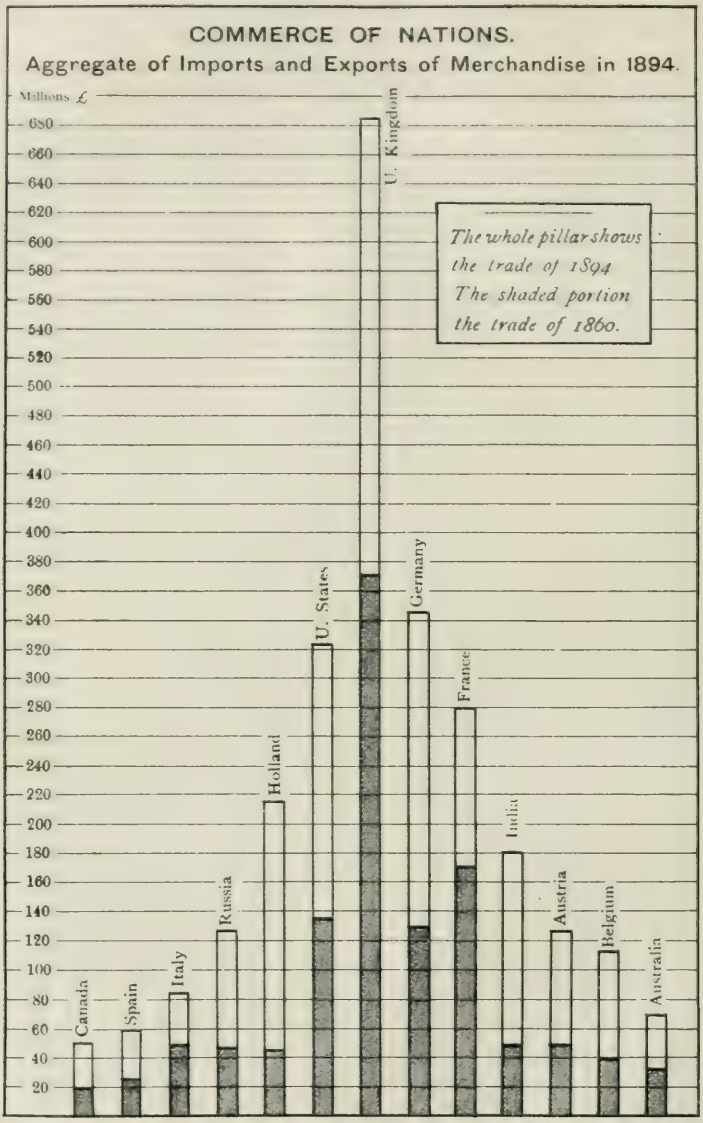
COMMERCE OF NATIONS.
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The whole pillar shows the trade of 1894
The shaded portion the trade of 1860.
U. Kingdom
U. States
Germany
France
India
Holland
Russia
Austria
Belgium
Italy
Spain
Australia
Canada

would have been as unintelligible as uninteresting. The selection of what is given under this head has been made judiciously, and the result, considering the space available, is very commendable. It is always a difficult task to secure accuracy in a compressed exposition. On the whole Mr. Frazer's history seems to us to be, in spite of this difficulty, both faithful and impartial, at least when he is dealing with his proper subject. But in the brief introductory sketch of the changes in the course of ancient trade between East and West we find not a few instances of inaccuracy or want of precision in statement which somewhat detract from the value of the work as a whole. To particularise these would give a wrong impression, and we therefore refrain. They do not concern the main subject of the book, which as a whole is as faithful as it is animated and interesting. The only statement we should there take objection to is the rather startling one that "the interest on public debt has grown at the rate of three millions of tens of rupees annually during the last twenty years." We presume that the debt, and not "the interest" on the debt, is meant. We do not understand why the publisher has impressed on the cover of the book the head of the French adventurer De Boigne. For such a book a less appropriate selection could hardly have been made.

The Chin Hills: A History of the People, our Dealings with them, their Customs and Manners, and a Gazetteer of their Country. By BERTRAM S. CAREY, C.I.E., Assistant Commissioner, Burma, and Political Officer, Chin Hills, and H. N. TUCK, Extra-Assistant Commissioner, Burma, and Assistant Political Officer, Chin Hills. 2 vols. Rangoon: Printed by the Superintendent, Government Printing, 1896. Pp. cclv + 236.

The Chin Hills, treated of in these interesting volumes, constitute an administrative district of Burma, taken as a section out of a much larger tract of similar characteristics, which came under British sway soon after the annexation of Upper Burma. The tract in question includes a multiplex mass of mountains intersected by deep valleys, and utterly devoid of plains or table-lands, extending from the Himalayas north of Assam, and occupying the country between Assam, Bengal, Arakan, and Burma.

Although contiguously situated with long-occupied British provinces, the tract remained unexplored and virtually a *terra incognita* until the occupation of Upper Burma. In the historical accounts of the old frontier relations between the British authorities and their lawless neighbours, it is shown how, out of the unknown ranges, slaving and head-hunting forays burst into Bengal and Assam from time to time, beginning from the early years of the present century; and although these raids were not altogether left unavenged—the notable punitive expeditions being those of 1842, 1849, 1859, 1869, and 1871—no attempt had been made to penetrate beyond the fringe of the very difficult country. Burma had been treated as a still happier hunting-ground by the daring and hardy tribesmen of the hilly region, the punishment of their raids having been more feebly dealt with by the King's Government, and from Burma the Chins, the tribesmen who were its nearest neighbours, appear to have been able to carry off slaves much as they pleased. The other tribes of the tract are the Kukis, occupying the hills bordering on Bengal, and the Lushais and Nagas bordering on Assam. After the annexation of Upper Burma in 1886, two years were spent in introducing order into the more accessible parts before attention could be directed to the Chins and other tribes between Burma and India, and then the submission of these independent tribesmen was not to be readily obtained. Operations could only be conducted during the dry months of each year, and fighting was thus protracted

for five seasons, each of the six principal clans which compose the Chin tribe having to be attacked separately or nearly so, and each clan or group maintaining a belief in their power to resist British authority. The final struggle in 1892-93 was preceded by a serious rebellion of two of the principal clans, which required the employment of a large force, and involved the adoption of severe repressive measures. The policy of a general disarmament was also resorted to, bridle roads throughout the tract were required to be made by the people themselves, and in the following year all the clans of the Chins had begun to acquiesce in the new condition of things. Relaxation then became possible from the harassing work in which the troops and civil officers had been engaged for so long, as is well and fully described by the civil officers themselves who are the authors of the gazetteer, and who were responsible for controlling the operations.

The particulars recorded regarding the different clans inhabiting the Chin Hills show that the people have been studied from other aspects besides their fighting powers and raiding proclivities, and much information is furnished concerning their blood feuds, their religious beliefs, their marriage and burial customs, the houses they build, and the crops they cultivate. Their system of agriculture is good, and it is on their crops they mainly depend for their sustenance, although they eat flesh eagerly when they can get it. Under the old *régime* they had largely depended for field labour and for household service on Burman slaves; also they could look to the raiding and ransoming of Burman captives as a sure means of obtaining guns, gongs, salt, or other luxuries. Now they earn money by carrying Government stores or by labour on public works. They have nothing to trade in except a little beeswax and horns of buffaloes or deer.

"The Chins, Lushais, and Kukis are noted for the secrecy of their plans, the suddenness of their raids, and their extraordinary speed in retreating to their fastnesses. Raids may still be heard of, for the people love them."

The gazetteer is appropriately illustrated with heliogravure plates of some types of the people.

Irlande et Cavernes Anglaises. Par E. A. Martel. Paris: Librairie Ch. Delagrave, 1897. Pp. 403. *Prix F.* 7.50; *en toile F.* 10.

M. Martel explains that the two motives which induced him to write this book were the success attending his explorations in the subterranean caverns of England and Ireland, undertaken by him in 1895 at the instance of the Ministère de l'Instruction Publique; and, secondly, the deep interest aroused in him by the natural beauties and the archæological treasures of Ireland. The main purpose which he had in view during his visit to our country was of course the scientific study of those amazing underground labyrinths, unknown to many of ourselves, which exist in various parts of our islands, and to compare these with the similar caverns found in other countries of Europe, to the careful examination of which he has devoted much of his past time. But although the book concerns itself chiefly with detailed descriptions of the English and Irish grottoes and other natural phenomena visited by M. Martel, there is a very great deal in its earlier chapters which relates to the antiquarian remains and the present condition of Ireland. M. Martel purposely avoids any serious discussion of Irish social and political problems; but, in referring to these casually, he speaks of the country with admiration, and of the people with great friendliness. It may be added that he testifies to the present peaceful state of Ireland, and that he does not see any signs of the existence of sedition, or any reason why it should exist.

After exploring the Marble Arch caverns and those of Mitchelstown and

Gort, besides inspecting the Giant's Causeway and other natural features of Ireland, M. Martel proceeded to England, where he visited the famous souterrains of Ingleborough and the Peak. Of these, as of his Irish experiences, the book gives a faithful record ; and the numerous excellent illustrations throughout the work not only enliven its appearance, but instruct the reader in the most effective manner. It is a little humbling that a foreigner should lead the way, as M. Martel has done, in the exploration of Gaping-Ghyll (Yorkshire) and Marble Arch (Enniskillen). *En revanche*, however, it was a Scotchman who revealed the secrets of the Bossenno at Carnac. After all, science is nothing if it is not cosmopolitan ; and we, as well as his fellow-countrymen, ought to feel grateful to the accomplished author of this most instructive and most readable book.

From Batum to Baghdad, viâ Tiflis, Tabriz, and Persian Kurdistan. By Walter B. Harris. Edinburgh : William Blackwood and Sons, 1896. Pp. xii + 335. *Price* 12*s.*

Mr. Walter B. Harris has lately made an interesting journey through Armenia and Persian Kurdistan. The parts of Armenia he traversed were within Russian and Persian territory, and, as we know from Supan's map, the proportion of Armenians is greater in these regions than in Turkish Armenia, for in some districts Armenians actually form half the population. Russian Armenia is still the centre of the Armenian religion, and a visit was paid from Erivan to the great monastery of Echmiazin, whose schools left a most favourable impression.

Mr. Harris carefully avoids discussing the political aspects of the Armenian question. He cannot avoid noting, however, the changes that are apparent on leaving Russian for Persian territory. The differences are not in the nature of the country or the people, but in the political organisation. He says :—"What may be the system of government in vogue in other portions of Persia I cannot say, but this I do assert, that for absolute cruelty, corruption, and oppression, the province of Azerbaijan stands unparalleled in my experience." Marocco, Turkey, China, are not so misgoverned ; "the ill-used and often squeezed Galla lives under the cruel yoke of Abyssinia in a state of freedom and happiness far surpassing that of the peasant of the 'rich province of Azerbaijan.'" . . .

Despite this, Tabriz, the chief town, remains a great city. It has still over 200,000 inhabitants, although it has been destroyed by earthquakes seven times in eleven centuries, besides enduring several sieges. Its vitality is explained by its position as the natural trade centre of north-western Persia, lying on the great caravan route from Trebizond to Tehran. But in recent years its importance has been somewhat lessened by the development of Russian trade with Persia by the Caspian, and by the Persian Gulf route, with its lower transport rates.

In addition to the bazaars, there are only two sights of importance in Tabriz : the Blue Mosque, with its exquisite faïence, and the Ark or fortress, whose walls are nearly twenty-eight feet thick.

After leaving Tabriz, Mr. Harris wandered through the mountainous regions south of Lake Urumia—Persian Kurdistan. He gives an interesting account of the Kurds, who are not all so stupid and ignorant as Mr. Curzon thinks, for a distinction must be drawn between the sedentary cultivator of the soil and the migratory shepherd, who is usually his master. The latter, "rich in cattle, which his servants graze, spends his winters in the warm houses, often more dug out of the hillside than built, on account of warmth, and his summers in his brown tents away up on the slopes and plateaux of the great mountain chains by which

his country is threaded." The Kurd is a law unto himself, and practically free from any restraint of Sultan or Shah.

The heat became terrific before Baghdad was reached about the end of June, and the steamer took the traveller down the Tigris to Busra.

At Shaharaban, with a poor mat-covered bazaar, there was one significant curiosity,—the matches bore the inscription "Made in Japan," and were sold at a farthing a box, in spite of the long voyage by sea and river and caravan.

This, like all Mr. Harris's books, is an interesting chronicle of a shrewd and sympathetic traveller, who sees and thinks for himself, and whose testimony is well worth weighing.

On the Nile with a Camera. By ANTHONY WILKIN. With 111 Illustrations. London: T. Fisher Unwin, 1896. Pp. xv+238. *Price* 21*s.*

The author of this work feels it necessary to apologise for the appearance of another book on Egypt by the passing tourist, and gives as his excuse the number of original photographs of interesting places which he can supply. These are for the most part well chosen, but are by no means all successfully produced, or of any striking merit. He writes, he tells us, both for the untravelled reader and for those to whom the country is familiar; but surely even the former hardly need an elaborate description of the *sakia* (water wheel) and *shaduf* (pole and bucket), or of the institution of *bakshish*! On the other hand, he merely names, without explaining, the Barrage. For the rest he is a conscientious traveller, and does his temples and other sights appreciatingly and with diligence, and by intelligent use of his guide-book and the aid of miscellaneous chat, he can carry his reader pleasantly along with him over the familar track, which he traversed under the much-lauded auspices of Mr. John Cook. But no mundane arrangements are perfect. At Abydos he "had as uncomfortable a lunch as it had ever been my lot to eat." True, ices and other luxuries were provided, but there was "the inconvenience of having nowhere to sit down!" In Nubia he "failed to find any distinctive Nubian race." But he does not seem to have known the type of which he was in search.

We are sorry to learn from him that the important sculptures at Beni-Hassan are still unprotected against vandalism of natives or tourists. Old travellers in Egypt will read with surprise of the fogs and rain and ungenial weather now met with far up the river.

The Madeira Islands. By ANTHONY J. DREXEL BIDDLE. Philadelphia: Drexel Biddle and Bradley, 1896. Pp. 111. *Price* $2.

The author of this interesting and prettily illustrated handbook summarises the present situation at Madeira thus: "A large and influential colony of English residents own and control the chief interests of the island. They would be all-powerful did they hold the key to improvement—viz., the Government. Three-fourths of the wine trade are in the hands of the English, and nearly all the larger shipping firms and banking houses are owned and financiered by Englishmen. And here is where the 'rub' comes—the Portuguese hate the English." He continues: "Now, it so happens that, though they dislike the English, the Madeirans are great admirers of the Americans. An extraordinary idea exists among these simple islanders to the effect that our nation cannot get along without them much longer, . . . and that Uncle Sam is but awaiting a favourable opportunity to stretch forth his hand to the Madeirans, and lift them from under the monarchical Portuguese yoke," which they do not like. We are afraid that the Monroe doctrine does

not extend so far as Madeira. The author humorously recalls how his nerves were shattered during the first week he spent in Madeira, when, after a modest meal at a most respectable restaurant, he was presented with a bill for *one thousand reis*! He was not then aware that this enormous charge only amounted approximately to one dollar. Fortunately, British money is current in Madeira, and more plentiful than the coin of the country.

On the Threshold of Three Closed Lands—The Guild Outpost in the Eastern Himalayas. By the Rev. J. A. Graham, M.A. Introduction by Sir Charles A. Elliott, K.C.S.I., LL.D., late Lieutenant-Governor of Bengal. Edinburgh: R. and R. Clark; London: A. and C. Black, n.d. Pp. x + 166.

Primarily intended to make members of the Church of Scotland acquainted with the work which is being carried on with great success by their missionaries in the Himalayas, this book also contains many interesting details on the country, and the people that are met with in Kalimpong and the neighbourhood—the Marwari merchant from Bombay, the Nepalis, the Bhutias, under which name are included Tibetans, who are of the Bhot race, and the Lepchas of Independent Sikkim. It is a very readable little volume, being, as Sir Charles Elliott very accurately says, "brightly written"; and it is rendered still more attractive by 120 good illustrations, which are, at the same time, instructive.

A Survey of Foreign Missions. By the Rev. P. Barclay, M.A., author of *Concerning Home Missions*, etc. With Maps. Edinburgh and London: Wm. Blackwood and Sons, 1897. Pp. xxii + 272.

We have here a succinct account of the work being carried on by Protestant Churches in all parts of the world. The author has approached his subject in a liberal spirit, and duly recognises the services rendered in the missionary field by workers of all denominations. Though not strictly geographical, the work may fittingly be briefly mentioned here, for our earliest acquaintance with many remote regions has been due to missionary enterprise, while, on the other hand, a knowledge of geography is, as our author insists, quoting a passage from the *Magazine*, necessary to a thorough comprehension of missions. Being well prepared in this respect for the task he has undertaken, and writing in an easy, agreeable style, Mr. Barclay has produced a work that may be heartily recommended to all who are interested in the important subject it treats of.

Elementary Meteorology for High Schools and Colleges. By Frank Waldo, Ph.D. New York, etc.: American Book Company, n.d. Pp. 373. 121 Maps and Engravings.

The first noteworthy features of this work are the large and comprehensive amount of information compressed into it, and the clearness and precision with which the author discusses the subject. We note with pleasure the absence of long and uninteresting particulars regarding apparatus, which have rendered more than one treatise on meteorology little better than an illustrated catalogue of a philosophical instrument-maker. The book has been specially prepared "for high schools and colleges," and it seems to us that the writer has steadily kept this in view, avoiding the mathematical treatment of the field of inquiry as much as possible. It is impossible for us to deal exhaustively with this treatise, which begins with an excellent chapter on temperature, and works up gradually to the more complex and intricate questions of the general and secondary circulation of the atmosphere, the subject being unfolded in a masterly manner. As was to

be expected, the statements are sometimes a little too condensed: *e.g.* the subject of long period temperature oscillations (p. 48) is dismissed in a single paragraph, but perhaps the author participates in the growing disbelief in the existence of anything approaching a weather cycle. There are few omissions, but we note with regret the absence of any information regarding the results obtained from mountain observatories, to which the United States stood sponsor a quarter of a century ago, when the Mount Washington Station was inaugurated. The book is printed on good paper, and in a clear, bold type, while the excellence of the illustrations leaves nothing to be desired.

Grant Allen's Historical Guides: Paris. Florence. 2 vols. London: Grant Richards, 1897. *Each vol.* 3*s.* 6*d. net.*

After writing every kind of book, from scientific treatises to sensational novels, Mr. Grant Allen is now contributing a series of Guides (extremely handy in form) to the Continental Capitals of Europe, whereof those to Paris and Florence are the first to appear. Mr. Grant Allen states that whilst for ordinary details of travel (hotels, etc.) the tourist must have recourse to his Baedeker, Joanne, or Murray, these new Guides will supply him "with such historical and antiquarian information as will enable him to understand, and therefore to enjoy, the architecture, sculpture, painting, and minor arts of the towns he visits." Thus, instead of an ordinary map of the Paris of to-day, we find a map of "Historic Paris," showing how the city grew from the days of Philippe Auguste (1150) to those of Etienne Marcel (1356), and to those of Louis XIII. (1626). Anything which will make a foreign tour a means of culture, as well as a mere period of enjoyment, ought to be encouraged, and we welcome these little Guides as a new departure of value and interest. The ignorance of the ordinary tourist will receive many a rude reminder from Mr. Grant Allen's guides. For example, how many tourists visiting Paris know anything of St. Denis or St. Geneviève? Yet Mr. Grant Allen informs us that "round these two sacred personages the whole art and history of early Paris continually cluster. The beautiful figure of the simple peasant enthusiast, Ste. Geneviève, in particular, has largely coloured Parisian ideas and Parisian sympathies. Her shrine still attracts countless thousands of the faithful." The devotional side of Parisian life has certainly not hitherto struck the average tourist.

Orient Line Guide. Chapters for Travellers by Sea and Land. Edited for the Managers of the Line by W. J. Loftie, B.A., F.S.A. London: Sampson Low, Marston, and Co., 1896. Pp. li+431. *Price* 2*s.* 6*d.*

The chapters here collected treat of the route to the East and the ports of call on the way, the Australian colonies, stars, navigation and seamanship, etc., besides information especially necessary for travellers. The book contains several illustrations and a number of good maps and charts. Though not recently compiled, the preface being dated 1894, it is a very useful book for travellers and others.

The Australian Handbook, Shippers' and Importers' Directory and Business Guide for 1897. London, Melbourne, etc.: Gordon and Gotch. Pp. 614.

In their preface Messrs. Gordon and Gotch state every effort has been made to ensure that this, the twenty-eighth, edition of the *Handbook* should be up to date. In this they seem to have been thoroughly successful, the book maintaining its usual high standard. It is an indispensable book of reference to those interested in the Australian colonies.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE GEOGRAPHY OF COMMUNICATIONS.

By Sir Henry Tyler.

(Read before the Society at Edinburgh in May.)

Geography has been divided by various authors under different heads, such as (1) Physical, (2) Political, (3) Mathematical, having reference, respectively, (1) to the configuration of the Earth's surface, (2) to its division into countries and nations, (3) its magnitude, its motions, its problems, and its changes. But there is another section germane to the science, which has not yet received the special attention which it deserves, namely that of "Communications,"—for passengers, for commerce, and, postally or electrically, for the exchange of information.

When I was asked, some little time since, to address this Society, I naturally inquired as to the sort of subject which would be pleasing to your honourable Council; and I received in reply a request for suggestions. It then occurred to me, in thinking the matter over, that I could not do better than gather up the threads of work to which I had been constantly led during the numerous avocations of a busy life, in which I had always taken supreme interest, and which had formed the occasion of numerous official reports and visits to many countries, on duty or business, as well for instruction and pleasure. I was the more inclined to do so because I felt that although the study, in connection with the great facts of history, of routes and communications, had hitherto as a special subject been, so to speak, overlooked or neglected, yet these were in reality the basis of geographical discovery, and the foundation —the *fons et origo*—of geographical science. Without the means of communication, and without the use of those means, discovery could not be undertaken, the configuration of the Earth's surface could not be ascertained, its divisions could not be determined; and without prolonged

observations on the result of such investigations, its history, its problems, and its changes could not be recorded.

The subject, though most fascinating, is appallingly vast, extending in time over the whole of the Earth's records since the deluge, and in space over its entire surface. It cannot be satisfactorily dealt with, much less exhaustively treated, in an afternoon address; but as the Council of the Society were so good as to approve of my suggestion, I venture, in approaching the fringe of it, to lay before you a slight sketch, which I hope may be filled in and elaborated by some one with more leisure, learning, and ability, at a later date.

As the descendants of Noah multiplied on and dispersed over the surface of the old world, they naturally selected and mainly congregated in the localities best adapted for their support and pursuits; where they found favourable climates, water for transport and irrigation, food for their flocks and herds, and easy cultivation. The valleys of certain great rivers afforded these necessary conditions.

The mud-bearing Nile, and its periodical inundations, attracted them to Egypt; the Euphrates and the Tigris, and the fructifying soil from the Armenian Highlands, to Chaldæa, or Mesopotamia; the Indus and the fertilising Ganges to India; the great rivers of China, laden with yellow earth from the Tibetan plateaux, to that country. But great and constant changes occurred in the course of time, physically as well as politically. It has even been stated that six thousand years ago the Euphrates and the Tigris ran in separate channels to the sea; and that four thousand years ago "Ur of the Chaldees," the site of which is now 150 miles inland, was a flourishing sea-port.

The ancient and better known civilisations of Mizraim or Egypt, Chaldæa or Babylonia, Assyria, Elam or Persia, India and China, were the results (amidst continual change) of concentration and survival, after long struggles for supremacy amongst each other and with less perfect organisations. Another powerful empire—Khita (Heth), inhabited by the Hittites, has received the benefit of recent researches. Penta-ur's poem (the Egyptian *Iliad*) on the "Sallier Papyrus," and the sculptures on the walls of Thebes, and other records, have thrown a new light on the few references to it in the Old Testament. These Hittites, of which the better known tribes in the south of Palestine were, perhaps, remnants, occupied northern Syria and Asia Minor, south of the Black Sea and east of the Egean, and fortified their capitals at Kadesh on the Orontes, and Carchemish (Kar Chemosh), on the Euphrates. The Hittites' chariots, "each containing three men," were similar to those of Egypt; and Ramses II., that mighty Pharaoh, made a formal treaty of alliance with the Hittite king, Khita-sin, and, as an equal, received his daughter in marriage.

An interesting discovery has been made quite recently, on examination of the records in the British Museum and in the Imperial Museum at Constantinople, in connection with the battle of the Kings and the capture of Lot, with his "goods, and the women also, and the people," recorded in the 14th chapter of Genesis. This is recognised as having occurred shortly after the Elamite conquest of Chaldæa, B.C. 2285.

Amraphel, king of Shinar, is identified as Khammurapaltum, and Arioch, king of Ellasar, as Eri-Aku, whose clay tablets were found at Sankereh, the site of the ancient city of Larsa. In one deciphered letter Amraphel expresses a fear that the goddesses captured may bring trouble on those who keep them captive; and in another letter he requests that certain rebels captured may be sent to him to Babylon. It would appear that the same wave of invasion reached as far as Lower Egypt, when it was the means of establishing the dynasty of Hyksos, or shepherd kings, 2000-1490 B.C.

In these centres of population, cities of vast magnitude were formed, and were highly fortified, in some cases by numerous walls. Their names are very familiar to us, as Memphis, Babylon, Nineveh, Ecbatana, Persepolis, Tadmor (Palmyra), and others. All were more or less centres of commerce, and some dwarfed by their dimensions our modern cities; whilst, as at Troy, even five or six cities of different dates are found buried under the present sites. The powerful and ambitious potentates of those days, wielding arbitrary authority and having unlimited command of men and materials, invaded each other's territories, besieged each other's cities, carried off treasures, sacked and destroyed temples, towers, and monuments, and not unfrequently found their ruin in seeking further aggrandisement. They left behind them enduring treasures, such as the Pyramids and other massive constructions of Egypt—the buried antiquities of Asian cities—hieroglyphic and cuneiform records and inscriptions on basaltic and other rocks, on bricks, slabs, and monuments, to be deciphered by laborious and distinguished men, and handed down, in the marvellous designs of Providence, to the present later civilisations, on whom the ends of the world have come.

The directions of the lines of communication over the Earth's surface in earlier as well as in later ages have been determined mainly by (1) the exigencies of commercial intercourse, comprising the need of sustenance and the demand for luxuries; (2) the thirst for conquest, or craving after wealth and power; (3) the impulses of religion, including the resort to holy places and the propagation of creeds. These three C's—Commerce, Conquest, and Conversion—may be looked upon as the dominating motives for movement by land and sea.

Facilities for communication are afforded on water, by (*a*) the ocean, (*b*) lakes, (*c*) rivers, (*d*) canals; and on land by (*a*) unprepared or beaten tracks, (*b*) roads, (*c*) tramways and railways. The water routes, navigated by (*a*) floating rafts, with or without sails, (*b*) vessels propelled by oars, (*c*) sailing ships, (*d*) steam-ships, have afforded at all times more economical, and frequently more secure, modes of transport than long stretches of land across steppes, prairies, pampas, forests, and mountains.

Until the present century, and the railway era, great countries were practically joined together by water, whilst their own internal divisions were separated by the difficulties of land communication.

It was, for instance, almost impossible to cross North America from New York to San Francisco, or from Montreal to Vancouver, until the United States Railways and the Canadian Pacific Railway solved those

problems respectively, whilst the traffic and commerce between Great Britain and the American continent for similar distances were more easily carried across the Atlantic. The African continent, first circumnavigated by a Phœnician vessel under the auspices of Necho, son of Psammetichus, who succeeded to the throne of Egypt 617 B.C., affords similar examples of the difficulties of crossing it, compared with the facilities for coasting round it.

Rafts and canoes, boats and ships, of almost every conceivable form, have been employed to suit the wants of, or to utilise the materials available for, inland or ocean navigation at different times and in different countries. The canoe, scooped out of the trunk of a tree by the untutored Indian, was as inferior to the China clippers as were the ships of Tarshish to the steamers of 12,000 tons which now glide through the waves of the Atlantic at twenty-five miles an hour. Of all the vessels used for passengers and cargo, perhaps the most singular are the "balsas," which I found in a recent trip to Peru on Lake Titicaca, which is 100 miles long and 60 broad, and 12,500 feet above the sea. These "balsas" are formed entirely of the reeds and rushes growing in the lake, bound together in boat-like form, and furnished with sails of the same reed materials, with rough crooked poles for oars. They are frequently taken out of the water, when not in use, to prevent them from being too thoroughly soaked and thus losing their flotation. Some of them carry as many as sixty, but the smaller ones only two or three, people. A floating bridge over the Desaguadero river, running out of the lake, was supported on similar "balsas" before the existing rough causeway was constructed. The steamers of the Peruvian Corporation are also employed on that lake.

The great international traders and carriers of ancient times, and the earliest promoters on a grand scale of "geographical communications," are well known to have been the Phœnicians or Canaanites. They are most interesting to us as bearing a certain analogy to, and being in some respects the forerunners of, British enterprise. Phœnicia and Carthage, and, later, Holland and Great Britain, have alike demonstrated that smaller countries with convenient coasts and ports are, when backed by freedom for commerce and maritime enterprise, more compatible with commercial and colonial greatness than larger countries with greater populations. Whilst the main object of other ancient civilisations was conquest, the mainsprings of Phœnician life were ships, colonies, and commerce—for which Napoleon cried and sighed in vain. Inhabiting a narrow strip of the Syrian coast, 180 miles long by 12 miles broad, with ports at Sidon, and Tyre 24 miles south of it (both founded upwards of 2000 B.C.), as well as at Byblus, Berytus (Beyrout), and Ace (afterwards Ptolemais and now Acre), their trade-routes spread over the then known world. They had two land routes to the Euphrates and Tigris—a northerly route through Mesopotamia, Haran, and Eden; a southerly route by Sheba, Ashur, and Chilmad. The ships of Tarshish resorted to the British islands and coasts (*Cassiterides*) for tin, and to Spain for oil, wine, gold, silver, copper, lead, and quicksilver, and they exchanged in the lovely island of Ceylon the products of the East and the West. Ceylon was, no doubt, their

Eastern Tarshish, whilst the Isla de Leon (Ταρτησσός, Gades. or Cadiz) was their Western Tarshish. The ancient Buddhist civilisation of Ceylon, now so little known or appreciated, formed indeed the commercial centre of the Eastern world. The wonderful city of Amuradhapura was almost unrivalled for extent, palaces, and Buddhist buildings. A vast population was supported, and the island rendered fertile by tank, canal, and irrigation works on a grand scale, and the ships of the Phœnicians and of Solomon found there the produce of India, Java, and China.

In the 26th, 27th, and 28th chapters of Ezekiel a full and poetical description is given of the merchandise and the traffic of the Phœnicians by sea and land, and of their pride and riches. The prophecies by Isaiah and Ezekiel of the fall of Tyre and Sidon were amply fulfilled in the sacking of Sidon with terrible carnage, and the subsequent capture of Tyre, 590 B.C., after a thirteen years' siege by Nebuchadnezzar, when 8000 persons are said to have been massacred, 30,000 sold into slavery, and 2000 crucified. It was partially restored, and again captured, after a seven months' siege by Alexander the Great, 332 B.C., as well as by the army and fleet of Antigonus after a thirteen months' siege, 314 B.C., by Christians, 1124 A.D., and by Mohammedans, 1291.

Carthage, the most important of the Phœnician colonies, with its million of inhabitants and its city twenty miles in circumference, founded 814 B.C., became the next great commercial centre of the world. From the fifth century B.C. the Carthagenians waged great wars, first with the Greeks for Sicily, and afterwards with the Romans. Their generals, including Hannibal, nearly conquered the world; but, at length, this last remnant of Phœnician power was worn out and broken in the Punic wars, and its defeat was said to be a "gain for the world," though it had certainly contributed in an important degree to geographical discovery, and was the means of furthering settlement and civilisation in Western Europe. These Phœnician worshippers of Baal, Moloch, and Ashtaroth (Astarte), whose idolatry and human sacrifices the Israelites were too prone to imitate, did not bear a good character for honesty. It was said of them Σύροι πρὸς Φοίνικας, liberally translated as "Set a thief to catch a thief."

The Roman navies were constructed and employed rather for objects of war than for purposes of commerce. At the same time, as the Romans advanced civilisation over barbarous regions in the West, so they created a demand for the manufactures of the East; and the extreme luxury of Rome called for satisfaction from every portion of its vast Empire. The most distant ports of the East were ransacked to supply the wants of the capital, and accordingly large fleets were employed between Myos Hormos, on the Red Sea, and the island of Ceylon, or the coast of Malabar, to transport, at enormous profits, rich cargoes which were carried on the backs of camels to the Nile, and so by water to Alexandria, for Italy, whilst the Mediterranean vessels were also laden with the manufactures of Babylonia and other eastern regions.

As with water carriage so also with land transport, the facilities have varied from time to time, according to conditions and the progress of

ingenuity and invention. The earliest caravan of which we have any record was that of the Midianite merchantmen, with camels bearing spices and balm and myrrh, to which Joseph was sold by his brethren. Beginning with unbeaten, and going on to beaten tracks, the routes traversed for purposes of commerce, and by military expeditions for purposes of conquest, were not roads as we now understand the meaning of the word. The despotic rulers of the ancient civilisations would appear in a great measure to have done without them, having unlimited resources in the way of labour, but not being provided with modern tools, and only being compelled to expend mechanical labour in preparing their tracks for passing through forests, or over mountainous regions; whilst the two great arteries of the Tigris and Euphrates were the chief highways of communication, and the deserts were crossed in various directions by caravan tracks. There is indeed—to enable us to understand such conditions—no lack of examples of indifferent tracks or of the want of roads in this century, or even at the present day, as described by innumerable travellers, and as I have seen in recent years in travelling through South Africa, in riding through Bosnia and other parts of Europe, and in North and South America. The corduroy roads of Canada and the United States, where timber is plentiful—the asphalt of the pitch lake in Trinidad and of other regions, and various devices, according to local circumstances, have from time to time afforded means of partially overcoming the difficulties of dragging wheeled vehicles through difficult countries. In tropical countries of luxuriant vegetation, tracks or roads when made require constant maintenance, or they rapidly disappear; and the difficulties of maintenance have, no doubt, in past ages, quite as much as the difficulties of construction, been a bar to facilities of communication.

The Carthagenians are said to have been the first to construct roads with solid foundations, paved with hard material, and curved on the surface. The Romans, following their example, extended such roads throughout their Empire. They constructed 14,000 miles of road in Italy, most of which are still utilised; and they connected the capital with the extremities of their dominions in all directions, forming, amongst others, a continuous route (except the sea passages Sandwich to Boulogne, forty-two miles, and Brundusium to Dyracchium, thirty-eight miles) from the Wall of Antoninus, connecting the Forth and the Clyde, eastward to Jerusalem, of about 3750 miles. Although the primary objects were facility of communication and rapidity of military movement to consolidate conquests, yet these grand highways subserved the not less important objects of civilisation, agriculture and commerce, besides sometimes affording facilities to robbers and highwaymen. These roads ran from city to city, regardless of obstructions or the rights of property, and the distances were accurately marked out by milestones; whilst post-houses were provided a few miles apart, with horses and all materials for imperial, and occasionally for private, services. With relays of horses a hundred miles a day were accomplished without difficulty. When the Prætorian Guards, after atrociously murdering the honest Pertinax, and literally putting the Empire up to auction, received £200 a head as its

purchase from the silly old Didius Julianus, A.D. 193, the most distant legions prepared to advance on Rome under their various commanders; and Septimus Severus, on foot, in complete armour, actually marched at the head of the columns of his Pannonian army at the rate of about twenty miles a day from the banks of the Danube to those of the Tiber, with a short halt about seventy miles from Rome, between the 13th of April and the 2nd June; this prodigious *iter* proving the goodness of the roads, the discipline of the legions, and the facility for obtaining provisions *en route* for a numerous army.

The oldest and perhaps the best known of the Roman roads was the Appian Way (Regina Viarum), laid on foundations of cemented strata, and paved with blocks of basaltic lava. It was partly formed in 313 B.C., from Rome to the Three Taverns, Appii Forum, and Capua, forty-two miles, and thence later to Tarentum (Tarento), and Brundusium (Brindisi), 242 miles. I may here say, by way of parenthesis, that after a careful inspection of the railways and ports of Italy on behalf of H.M. Government in the year 1866, I had the honour to select and recommend this port of Brindisi, with certain improvements, which were carried out, as the point of departure for our Eastern Mails, and it has since been used for that purpose. The Ostian Road led to the mouth of the Tiber. The Aurelian Road, by Genoa and the Mont Cenis, improved by Pompey the Great, formed, as the Strada Romana, the oldest route into Gallia. The Flaminian Way led to Ancona, Bologna, Venetia. There were others, too numerous to mention, and the Tiburtine Road is said still to exhibit the blocks of stone used in its construction some 2000 years ago.

Of the roads made or improved by the Romans in England, the best known (in regard to which, however, antiquaries differ) are the Vitellian Way or Watling Street, passing from Dover, near London, west of St. Albans, through Dunstable, Towcester, Weedon, Atherston, to Wroxeter, and thence to Cardigan Bay; the Ikeneld Street (after the Iceni) from Berkshire to Suffolk and Tynemouth; the Fosse Way (defended by a ditch) from Cornwall by Tetbury, Coventry and Leicester, to Lincoln; the Ermin Street (after Irmin or Mercury) from St. Davids through Gloucester to Winchester and Southampton.

But wealth and luxury, tyranny and wickedness, sapped the vitals of the Roman Empire. Gibbon has described to us in stately and stirring periods the memorable series of revolutions, extending over thirteen centuries, which gradually undermined and at length destroyed that "solid fabric of human greatness."

As illustrations of the Asiatic routes, I may cite that Cyrus in proceeding against Crœsus, King of Lydia, did not take the shortest, afterwards the Via Regia (Royal Road) through Diarbekr, but the more circuitous route by way of Erzeroum, through North Cappadocia. Cyrus also marched from Sardis to Celænæ, through Lycaonia, Cilicia, Thapsacus, and along the banks of the Euphrates to Cunaxa. Crœsus, on his march against Cyrus, passed through Pessinus, Ancyra, Pteria. Xenophon and his 10,000 traversed another route, through the Cilician Gates, by Iconium, and returned from Cunaxa to Chrysopolis, opposite to Byzan-

tium (Constantinople). Tadmor (Palmyra) owed its importance to its position on a well-watered oasis in the Arabian desert, about half-way between Damascus, which was connected both with Tyre and Sidon, and Thapsacus on the Euphrates. It was thus on the high route of caravans between Assyria and the West. It was destroyed by Aurelian, 272 A.D.

The well-known expeditions of Alexander the Great were perhaps the most extraordinary on record. After destroying the Theban power, and subduing other states of Greece, he prepared, 334 B.C., for his invasion of Asia, with some 30,000 men and 4000 horse, destined, in marching from victory to victory, to subsist mainly on the spoils of their enemies. He defeated 600,000 men under Darius at Issus, captured Sardis, and devoted seven months to the siege and destruction of Tyre. He then passed down the Syrian coast to Pelusium (the gate of Egypt), and there, finding his fleet, which he sent along the Nile to Memphis, he marched across the desert to meet it, and made himself master of Egypt. Returning to Phœnicia in the spring of 331 B.C., he reached Thapsacus towards the end of August; and at Arbela he won the second great battle over the hosts of Darius, which practically settled the fate of Persia. After acquiring enormous treasures at Babylon, Susa and Persepolis, he pursued Darius to his mountain palace at Ecbatana, and devoted three years to the subjugation of other provinces of the Persian Empire. In 327 he prepared to invade India. Crossing the Indus at Attock he defeated Porus, advanced to the Hydaspes (Jelum), and occupied the Punjab. He reached the Hyphasis (Beas), but his troops murmured, and compelled him to retreat again to the Hydaspes. He built a fleet, which took part of his army down the river, whilst the other part fought its way along the banks. He sent Nearchus with the fleet down to the Persian Gulf, and in 326 he marched, himself on foot, across the heated deserts, through Gedrosia (Baluchistan), sharing privations and fatigues with his soldiers. Another division of his army marched through Drangiana (Afghanistan) under Craterus, to join him in Carmania. His difficulties in the desert, and want of food and water, cost him enormous losses, but at Susa in 325 he and his army rested and feasted. At Babylon in 324 he despatched expeditions in various directions, surveyed the Euphrates, and drank deep at grand banquets, until his life terminated, after eleven days of fever, on the 28th June, 323 B.C., at the age of thirty-three. The he-goat of Daniel thus in eleven years conducted his army, whilst engaged in constant battles and sieges, over a distance of about 13,000 miles, and subdued the Persian Empire, which comprised the then known world. In the prophetic words of Daniel he "smote the ram and broke his two horns, and there was no power in the ram to stand before him, but he cast him down to the ground and stamped upon him, and there was none that could deliver the ram out of his hand."

Alexander received reinforcements from Greece at Susa and elsewhere from time to time, and employed mercenaries; and in opposing hordes of barbarians he was able to employ better armed and disciplined troops under his own impetuous leading; yet he had not the advantage of modern weapons by means of which European or other forces reckoned

by hundreds can successfully oppose in the present day so many thousands of inferior races.

Cyrus and Darius had prepared, if not paved, the way for Alexander in one respect. Appreciating the importance of rapid communication between and with the governors of far distant provinces, they had established stations with post-houses along the lines of route, between the chief cities of the Empire, so that messengers (*ἄγγαροι*) could thus gallop from post to post by night and day.

Taking a glance, in passing, at the "New World," amongst the greatest of the world's road-makers were the Incas of Peru, whose ancient civilisation and paternal form of government, extending over 500,000 square miles of territory, and 2500 miles of coast line, were destroyed by the Conquistadores under Pizarro and other ambitious, unscrupulous, and treasure-seeking Spaniards. The road from Quito to Cuzco, which was some 1500 miles long, and forty feet wide, was formed with stones ten feet square; and was planted with avenues of trees, and supplied with running water. Attaining levels of 14,000 feet and more above the sea, it passed over pathless and, at certain seasons, snow-clad sierras, through leagues of rock tunnels, and across great streams and torrents; and was carried over the ravines of the Andes by masonry built up solid from their greatest depths. The bridges across the mountain streams were from 100 to 250 feet in length, suspended at giddy heights, and constructed with the frailest of materials—cables and ropes of twisted osiers and vines stretched from bank to bank, bound together and floored with bamboo or timber. The roads across the Andes, in Central Peru from Callao and Lima, and in Southern Peru from Mollendo and Arequipa, have been superseded by railways now operated by the Peruvian Corporation—the Galera tunnel on the Central Railway being at the same height as the summit of Mont Blanc, some 15,665 feet; and the Southern Railway reaching Lake Titicaca, 100 miles long by 60 miles wide, and 12,500 feet above the sea, at Puno, after passing a summit of 14,666 feet. The steamers on the lake belonging to the Peruvian Corporation carry goods and passengers to and from Bolivia, and copper ores from the Corocoro mines along the Desaguadero river. The shallows and marshes connected with this river, as it leaves the lake, form a most interesting home for water-fowl of all descriptions; whilst over vast areas of Pampas in Peru and Bolivia, at 13,000 or 14,000 feet above the sea, are herds of llamas, alpacas, vicuñas, cattle, and sheep.

But whilst there is so much to admire in the works left by the Incas of Peru, constructed some 400 or more years ago, in the way of roads, aqueducts, temples, and fortresses, and still more to wonder at in the cyclopean and other ruins remaining from a still earlier civilisation, to which no dates can be affixed, there is also much to lament in the present condition of the country as regards roads and communications, and the prospect of developing its mineral and agricultural resources. Much capital is required for those purposes, but, as the result of misgovernment and too frequent revolutions, confidence and credit are wanting. It is to be hoped they may some day be restored. Millions of acres of magnificent land in the Amazonian regions could be brought into cultiva-

tion; and a colony has been started by the Peruvian Corporation on the banks of the Perené, 1800 or 2000 feet above the sea, where the best of coffee is already produced. But 100 miles of narrow-gauge railway is required, at a cost of £450,000, which could be chiefly worked by the unlimited water-power flowing down the slopes of the Andes, to connect the existing terminus at Oroya, *viâ* Tarma, with the Perené region, and to supersede the mountain roads and tracks, along which the wretched horses, mules, and donkeys now carry their loads of aguardiente, coffee, timber, etc., whilst a few passengers in meeting or passing them struggle with them for safety round narrow ledges on precipitous mountain sides. The well-known mines of Cerro de Pasco, as well as others, also require improved means of communication, and work in unwatering, for their future development. The well-known Huanchacha mines of Bolivia are connected by a branch with the narrow-gauge railway, 578 miles long, from Oruro to Antofagasta, which does admirable work, and along which I travelled after leaving La Paz rather more than a year ago, having made a prolonged tour through Peru in the regions to which I have above referred.

The great ambition of Peru and its rulers is to open up communication *viâ* the Perené and other rivers, including the Ucayali, and *viâ* Iquitos and Manaos on the Amazon, to the Atlantic. The distance from Callao to Para by this route I found to be 3565 statute miles, and the distance by that route from Callao to Southampton is 1000 miles greater than that *viâ* Panama. Having regard to the difficulties of navigation, and of making and keeping open roads in these tropical regions, it is evident that they must be contented in the first instance to improve their communications between the Central Railway and the Perené. These have fallen into a worse condition of late, the money taken at the garitas or toll-houses having been diverted to other purposes. Especially should this route be improved if the Panama Canal is completed, as is possible now on the revised scheme of the new company, in five or six years, if only the money required be found for it and honestly expended. The prospect of its completion seemed much more hopeful when I made a careful inspection of the works, the machinery, and the route, in company with the officers of the company in the autumn of 1895. It was then proposed to surmount the great difficulties of the Culebra cutting by the construction of ten locks, and the reduction of the depth of that cutting by 160 feet; and to overcome the other great difficulty of the Chagres river, by the construction of dams in suitable situations so as to form two great lakes, each upwards of twenty miles long, by means of which the river would be turned into a useful ally instead of a destructive enemy, and would provide water for the future use of the canal.

The completion of the railway route across the Andes, in which there is still a break between Chile and Argentina, is shortly to be undertaken, and then railway communication will be complete by that route between the Pacific and the Atlantic.

"Millions died that Cæsar might be great," and ten million human beings are estimated to have perished that Spain might acquire and ruin her American possessions.

The six centuries following upon the destruction of the Western division of the Roman Empire, 476 A.D. (1421 years ago), comprise the most melancholy period in the history of the human race. Babylonia, Egypt, and Assyria, after constant wars, became provinces of Persia. Persia was conquered by the Greeks, who in their turn made way for Roman ascendancy. Nebuchadnezzar had ruined the commercial prosperity of the Phœnicians. Alexander and Antigonus completed their destruction in Syria. The Romans destroyed Carthage and most of the remaining commerce of the Western world. The northern barbarians sacked Rome and brought to a close the glories and disgraces of the Western Empire. The mighty cities of Western Asia disappeared. The remains of the world's foreign trade between Europe, Asia, and Egypt were carried through Constantinople by Greeks and Venetians, the latter supplying the Saracen slave market in exchange for Asiatic luxuries. Though the old civilisations had been wiped out, yet the centre of commerce was still in the East. In Europe, ignorance, poverty, lawlessness, extortion, robbery, superstition, and vice prevailed. Internal as well as foreign trade dwindled and decayed. Travellers were waylaid, plundered, and sold into slavery. Agriculture was sacrificed to sport, manufactures were neglected, and absolute necessaries, including clothes, were locally produced. From England slaves were exported, after the Conquest, to Ireland. The world had to depend upon Scandinavians for enterprise, on the religious bodies for exploration, on the Arabs for science and art. Only 100 years after the Hegira (622 A.D.) conquering Arabs occupied Spain, and menaced the rest of Europe. France and Germany were saved from their grasp by the seven days' combat in 732 A.D., in which 300,000 Moslems were sent to their last account in conflict with the forces of Charles Martel. The Crusades mainly occupied Europe and Syria from 1097 to 1250. Genghis Khan, the greatest and most sanguinary of conquerors, was from 1201 for twenty-six years the terror of Asia. He invaded Turkestan in 1218 with 700,000 men, stormed Bokhara and Samarcand, and is computed to have exterminated 5,000,000 human beings. Tamerlane from 1362 proceeded from conquest to conquest, and also, with 700,000 men, routed the Turkish host in 1402; and he was only prevented from conquering China by his death in 1402. In his invasion of Syria, 1400, he is reported to have reared on the ruins of Bagdad a pyramid of 90,000 heads.

In the twelfth century Europe began to recover from her degraded condition. The Hanseatic League was formed in the middle of the thirteenth century, embracing ultimately sixty-six cities and thirty-four confederates, for mutual defence against piracy and pillage. It created new centres of trade and civilisation, connected its members together by roads and canals, exercised great political influence, and conferred substantial benefits on the north of Europe for two centuries. It was the "undisputed mistress of the Baltic and the German Ocean." The greatest powers sought its alliance and feared its hostility, until, with the fifteenth century, its influence declined. It was, in fact, no longer required, and the courses of trade changed on the discovery of America in 1492, and of the sea-route to India at the end of the century.

As commerce then revived, routes of communication by sea and land were re-opened. A religious order was founded in England, which spread into several continental countries, for repairing and improving roads and bridges as part of the *trinoda necessitas*. It was considered a pious work, and meritorious towards travellers, comparable to visitations of the sick and relief of the poor, for all of which remissions of the penalties on sins were granted. In 1660 the British public began to take a real interest in their highways, and, with better prices for agricultural produce, there was general improvement. But even in the sixteenth and seventeenth centuries there were still lamentable complaints in Europe generally. There was extreme difficulty in passing along the paths and tracks that existed. The ruts were deep, the hills precipitous, six horses were insufficient for the coaches, and oxen were also employed, even on the best routes. In England, Thoresby the antiquary lost his way between Doncaster and York; and Pepys and his wife between Newbury and Reading.

Parliament was kept waiting until the prelates, earls, barons, knights of the shire, and others, could make their ways through the mud. Goods were carried on trains of pack-horses at an expense almost prohibitive. Women travelled astride on horseback as well as men. In 1685, a Viceroy on his way to Ireland was unable to proceed in his coach more rapidly than fourteen miles in five hours, between St. Asaph and Conway, and was obliged to walk on to Beaumaris, with his wife carried in a litter. But after the peace of 1748, more serious attempts were made to ameliorate the wretched condition of the roads; and after 1760 a general improvement took place. As many as 452 Acts of Parliament were passed for roads, and nineteen for canals within fourteen years. General Wade began to construct roads through the Highlands of Scotland in 1726; and you will all remember the old rhyme by which the results were celebrated—only 165 years ago:—

> "If you'd seen these roads before they were made,
> You would hold up your hands and bless General Wade."

In the fifteenth century coaches of various descriptions came into use, and in 1564 a "showy vehicle" was built for Queen Elizabeth. The first stage-coach in Scotland seems to have been started by Provost Campbell in 1678. It ran between Edinburgh and Glasgow, "*drawn by sax able horses, to leave Edinburgh ilk Monday morning, and return again (God willing) ilk Saturday night.*" Mail coaches were introduced at Bristol in 1784, and from 1785 they became general in England. The first mail coach travelled between London and Edinburgh in 1785, and the first between London and Glasgow in 1788. It took longer then to go 400 miles from London to Edinburgh than it does now to go nearly 3000 miles from Liverpool to America.

The story of the commencement of the mail-coach system is too good to omit. Mr. John Palmer, manager of the Bath Theatre, was well acquainted with the great western road, which was much frequented, not merely by people of wealth and fashion, but also by high-class pro-

fessional gentlemen. When not engaged with travellers, the highwaymen amused themselves with taking extracts from the mails. Robberies were so frequent that the officials of the Post Office came to consider them as unavoidable, and requested the public to send bills of exchange and bank notes in halves only, remarking helplessly, in one case, that "*there are no other means of preventing robberies with effect, as it has been proved that the strongest carts that could be made, lined and bound with iron, were soon broken open by a robber*"; and in another case, "*when desperate fellows had once determined on a mail robbery, the consequence would be murder in case of resistance.*" The average speed of the mails was three and a half miles per hour, but their despatch and delivery were very irregular. When Mr. Palmer suggested mail-coaches, well-horsed, adapted for good speed, each in charge of an armed guard, he received an official reply of regret that he "*should not first have been informed of the nature of the business,*" and of assurance as to the constant endeavours towards improvement "*in all situations and under all circumstances,*" which had made them "*almost as perfect as can be without exhausting the revenue arising therefrom.*" It was only on a special appeal to Mr. Pitt that Mr. Palmer's mail-coaches were brought into use, and the postal net revenue was raised from £196,513 in 1784 to £1,100,606 in 1808.

The Bianconi Car was, to use an Irishism, the stage-coach of Ireland. It was similar to an outside Irish car, but with four in place of two wheels. The story of its successful introduction is equally characteristic with that of the English mail-coach. When Bianconi (afterwards Mayor of Clonmel) first constructed his cars, they were not looked upon with favour, and he feared the loss of his money. He therefore imported an "English Protestant coach," and ran it in opposition to create excitement; and having succeeded in this respect, he arranged for a collision in which the Protestant coach smashed up the Catholic car. By this means he at once secured the popularity of his cars and his own fortune.

We can many of us remember the perfection which mail and stage coaches and the posting system reached before the construction of railways. Diligences for public and private use were at the same time the ordinary, though inferior, means of conveyance on the Continent. I well remember being taken from Cheltenham to London in a post-chaise by my father and mother in 1835, doing the 100 miles in ten hours. I travelled by canal boats drawn by horses in Ireland in 1845; and I went from Rome to Naples in a diligence in 1855 in forty hours, with five examinations of passports and two of luggage in the 120 miles, a sharp look-out being kept for banditti. In other parts of Italy we had not only horses and mules, but also oxen, and even cows with women to drive them, to assist our vehicles over the mountains.

Brigands and highwaymen have acted powerfully in restraint of communication even in modern times, not only in Turkey, Italy, and Greece, but also in England. Robin Hood and Little John flourished from 1189 to 1247. Claud du Val, regretted by many of the fair sex, died at Tyburn, 1670. M'Cabe was hanged at Nass twenty-one years later. I have, however, found even brigands useful, and afforded them honest employment. When I was at Athens 1868-9, making the Athens

and Piræus Railway, I found difficulty in obtaining protection for the works from those who were hostile to them until I hired six brigands, who saved me all further trouble, and were perfectly loyal, as they usually are to those who employ them. When I was later at Salonica, in 1875, in the course of an arbitration between the Turkish Government and Baron Hirsch, I heard from the well-known Consul-General Blunt and Mrs. Blunt, that whilst he was in the mountains assisting in the search for a noted brigand and murderer, Mrs. Blunt, who became anxious about his long absence, made known her desire to join him, and her wish for an escort. A most polite individual appeared, told her he knew well where her husband was, and offered for a certain sum to convey her safely to him. Mrs. Blunt accepted the offer, received careful attention from him in riding with her, and sleeping at her tent door; and, after safely reaching her husband, she paid him his stipulated reward. They found later that he was the brigand chief whom Mr. Blunt was assisting to hunt down.

In making my plans at Turin (then the capital) for inspecting the railways and ports of Italy in 1866, for the purposes already referred to, I proposed to cross Calabria, in place of going round by sea, but was told by the Italian minister, Jacini, that he could not allow me to do so, as he could not even with an escort of 100 Carabinieri protect me from the brigands. But there were brigands at the hotels as well as in the country, as I found when the landlord at Brindisi charged me for sixteen beds, and my Italian companion for eight beds, after a twenty-five hours' sojourn in his hotel. These charges were made on the grounds that the room I occupied could have been used for four beds, and an ante-room through which it was approached for four beds more, and that we ought to pay for two nights. Having settled the bill, I insisted on sleeping there for the second night for which I had been compelled to pay, and thus turned the tables on mine host, who became very angry, because he could otherwise have made more money out of a shipload of Garibaldians just landed in the port, in view of the expected war with Austria. Such attempts at imposition, which were then very common in the south of Italy, also acted in restraint of the use of communications.

A good story of an English highwayman was told me twenty years ago by Mr. Corsellis, then my landlord at Wyvenhoe Hall. His uncle, a clergyman of the same name, was a man of powerful build, and had been a notable duellist. As he was about to travel out of London, his post-boy asked what he should do if they were stopped, and received the reply, "Go on and do as I tell you." In crossing a heath on the south of London the carriage came to a stand, and a gentleman of the road looked in at the window. Seeing the occupant of the carriage lolling back, and apparently asleep, this gentleman peered in further, to make more precise observations. As he did so, Mr. Corsellis seized his head with both hands, held it fast, and cried "Drive on, drive on." The highwayman was pulled off his horse, and dragged along, with his head in the iron hands of Mr. Corsellis, and his neck on the window-sill; and when the carriage stopped again, the highwayman was dead.

My apology for dealing too much, perhaps, in detail with the

difficulties of communication in the past, and even in recent times, is the conviction that without recalling them to mind, with the aid of personal reminiscences, it is impossible for any of us in the present generation to realise the extraordinary improvements that have so rapidly taken place in the Victorian Era. During the 4500, or any other number of years that chronologists may assume to have elapsed between the deluge and the present century, mankind was unprovided with those means of communication which are now so familiar to us all, by land and by sea, by telegraph and by telephone. And now that these are the commonplaces of our daily existence, it is difficult to understand how the business and pleasure of the world could have been carried on in the absence of them.

Inland navigation dates from the earliest ages, as practised by Egyptians, Assyrians, Hindus, and Chinese, but it was only after the Christian Era that canals were constructed in Greece, Italy, Spain, Sweden, Russia, France, and other parts of Europe. Until locks were invented in the fourteenth century, canals were employed at a disadvantage, the vessels having been previously raised or lowered by other devices, such as ramps or mechanical lifts. The Chinese were the earliest constructors of canals on a grand scale, the Imperial Canal, 1000 miles long, having been completed in 1289. The navigation of the system of the Saint Lawrence in North America, from the head of Lake Superior to the Atlantic, 2600 miles, has been continually improved from time to time by widening and deepening the channels, and by the construction of canals to circumvent the obstructions occasioned by rapids and by the different levels of the great lakes; and it is still in course of further improvement, so as to enable larger vessels to pass through the whole length. There is now a Canadian canal by the side of the American canal which served for so many years at the Saulte Sainte Marie (falls of St. Mary), between Lake Superior and Lake Huron. The amount of traffic on the St. Clair River, which runs between Lake Huron and Lake Erie, though it is closed by ice for five or six months, has increased so much (as I have had occasion to notice during annual visits to it for nearly twenty years), as to exceed the traffic through the Suez Canal. Steamers towing sailing vessels are constantly passing through it by night, as every stranger who tries to sleep on its banks can testify, as well as by day. The Erie Canal, from Lake Erie to the Hudson River, also carries a very large traffic, especially of grain. John Law, of Edinburgh, controller of the finances in France, opened a French bank in 1716, and proposed by the profits of his Mississippi scheme to pay off the French national debt. The nominal capital was £100,000,000, but wholesale ruin resulted on its explosion in 1720. In Great Britain there are, including the Caledonian Canal, upwards of 4000 miles of canals, many of which have been of enormous use in the manufacturing districts, though they are of less importance since railways have been constructed. On the Forth and Clyde Canal steam-towing was first used in 1789. Holland is intersected by canals in all directions. The total length of water navigation in Russia is about 35,000 miles, made up of shallow systems, navigable rivers and

connecting canals. The Russians have for the last twenty years had in view the establishment of a through water-route from the Baltic to Afghanistan, to solve a question raised by Peter the Great, which mainly depends on the practicability of re-establishing the ancient channel of the Amou Darya to the Caspian Sea, by diverting it from its existing course into the Aral. This question was raised again last year as a mode of opening up the markets of India to Russian commerce. In France 3800 miles of inland navigation have been established in the past 300 years, and further expenditure to a considerable amount is contemplated. In Germany, especially, canal traffic has acquired increased importance of late years. The North Sea and Baltic Canal has not proved a commercial success, but there are 8700 miles of canalised routes affording good and cheap communication, and in many cases competing with the railways. The employment of these routes is, however, more profitable to the freighters than to the carriers, as I know to my cost, from being the not too fortunate proprietor of a large business of this description, running steamers and barges between Hamburg and Berlin. The Suez Canal, at a cost of £20,000,000, saves 3750 miles of ocean navigation. It is believed that water communication existed 600 years B.C. between the Red Sea and the Mediterranean, which later fell into disuse; so that Eastern trade went first by the Red Sea, then round the Cape of Good Hope, and now again resumes its course by the Red Sea, but may once more be changed in the event of war.

The greatest changes that have been produced in the "Geography of Communications" have resulted from the use of steam power and the construction of railways. Gradually in the seventeenth and eighteenth centuries the first crude ideas fructified, until steam-boats came into practical employment in the beginning of the nineteenth century on both sides of the Atlantic. The *Clermont* steamed from New York to Albany in 1807. The *Comet* was launched on the Clyde in 1812. The *Savannah*, with auxiliary engines, crossed from New York to Liverpool in twenty-six days in 1819. The *Great Western* steamed to New York from Bristol, and the *Sirius* from Cork, both in eighteen days, in 1838, and the former maintained its service for some years. In 1840 steamers traversed the Indian Ocean, and in 1845 the *Great Britain*, 3000 tons, built of iron, and propelled by means of a screw, commenced its career.

In the seventeenth and eighteenth centuries, also, tramways—first of wood, then of wood shod with iron, and next with edge-rails of cast iron—were employed in the North of England and the South of Scotland and other localities for the conveyance of mineral produce to ports of shipment, and for other purposes; and the first locomotive worked on the Merthyr-Tydvil railway in 1804. Locomotive power was employed on the Killingworth railway in 1814, and on the Stockton and Darlington railway passengers were carried in 1825. The Liverpool and Manchester railway was opened in 1830, the Liverpool and Birmingham in 1837, and the London and Birmingham in 1838. Other railways followed, until in 1870 £530,000,000 had been expended in their construction.

During the lifetime of many of us, therefore, and practically in the

Victorian Era, the railways and steamships by which the traffic and commerce of the world are now so efficiently conducted, and have been so enormously increased, have come into existence.

There are now, in round figures, about 466,000 miles of railway open for traffic, made up of 160,000 in Europe, 250,000 in America, 30,000 in Asia, 10,000 in Africa, and 16,000 in Australia, which may be estimated to have cost upwards of £12,000,000,000. In the United Kingdom 22,000 miles have cost £1,020,000,000. China, now at last making a serious commencement, has yet to be provided for. Russia is preparing to extend her Siberian railway through Northern China, and her Transcaucasian railway *viâ* Teheran to the Indian Ocean. The Russian-Manchurian, or Chinese Eastern railway, will intersect the Chinese frontier at Staro-Tsurukaitui, and pass the towns of Chichihar, Hwang-chang and Ninguta, joining the Siberian line at Nikolskoie. Out of 1280 miles, as the total of the Manchurian railway, 946 will pass through Chinese territory. It will save 342 miles as compared with the line within the Russian border, and will pass through a better climate with more productive soil. Egypt is constructing 300 miles of railway between Wady Halfa and Abu Hamed, as another step towards completing her connection with the Soudan, and will, no doubt, when she regains possession of the Nile at Berber, construct the Suakin-Berber railway, and thus reduce the distance from Khartoum to the sea to 500 miles, as compared with 2000 miles by the Nile from Khartoum to Alexandria. This will, by placing the Red Sea in communication with thousands of miles of lake and river navigation, do more than any other railway to open out the fruitful regions of the Eastern Soudan to civilisation and commerce. Another railway will ere long be undertaken to Kano, the commercial centre of the Western Soudan, with 120,000 inhabitants; and in East Africa a line through German territory from Chiromo to Matope will connect Lake Nyassa with the sea. The railway through Rhodesia is being pushed forward to Buluwayo; but a vast amount remains to be done on the African continent as well as in other parts of the world.

Another extraordinary feature of recent times is the rapidity with which tramways, urban, suburban and others, have come into use. These are worked by horses, by steam, by cable, or by electricity. An iron tramway was opened for traffic between Croydon and Wandsworth in 1801. A horse railway was employed for passengers between New York and Haarlem in 1832. Since 1852 the tramcar has been making its way on both sides of the Atlantic, but more especially in America, which owns more miles of tramways than all the rest of the world. There is in that country more disposition to travel, the distances in the towns are greater, the roads were, and even now are, less adapted for easy travelling, and the cost of the hire of conveyances is prohibitive. On the elevated railroad in New York the trains run at one minute intervals, and the tramcars and omnibuses in that city are constantly overcrowded. Cable tramways are used in New York and Chicago; and in such cities as San Francisco and Kansas City the cars run rapidly, though the gradients on the roads are severe, and at close intervals. The towns, the cities and

many parts of the country in America are now provided with tramways, the "trolly" electrical system, with overhead wires, being that which is most in vogue. In 1860, Mr. Train, armed with American experience, sought to introduce tramways into Europe, but he found some prejudice to contend with, and there were not the same conditions to deal with as in American cities. During the last twenty years, however, tramways have spread over Europe until there are now some 10,000 miles at work, against upwards of 15,000 miles in America, as may be estimated, though there is no means of obtaining exact figures.

It is impossible to enumerate here the individual firms and companies, subsidised or unsubsidised, owning the merchant shipping of the world, or to dwell upon the details of the numbers of vessels employed, or the routes through every part of the habitable globe which they frequent. Omitting those below 100 tons, the grand total of ocean-going vessels amounts in round figures to 30,000, with an aggregate tonnage of 25,600,000. About 14,000 are steamers with 18,000,000 tons, and 16,000 are sailing vessels with 7,600,000 tons. Of the total tonnage, the United Kingdom claims 12,300,000, and its colonies upwards of 1,000,000, so that more than half the tonnage of the world belongs to the British Empire. The United States comes next, with 3200 vessels, and 2,235,000 tons, besides very large numbers of vessels for inland navigation. The Germans have 1650 vessels, and nearly 2,000,000 tons; the Norwegians 2900 vessels, and 1,670,000 tons; and the French 1160 vessels, with 1,130,000 tons. The French tonnage has slightly declined, although France has been paying bounties averaging £400,000 a year for the last ten years. The German tonnage has, on the other hand, advanced, as the result of a similar system. The French complain bitterly of the comparative uselessness of the ports round their coast on which they have lavished so much money, whilst Hamburg, Bremen, Antwerp, and Rotterdam go ahead. The enormous traffic in passengers and freight between Europe and North America has occasioned the construction of the largest and swiftest vessels for that route, until the Atlantic passage has been reduced to a few hours, more or less, above five days, in vessels of 12,000 tons, with engines of 30,000 h.p.

It is a magnificent sight to see half a dozen steamers of the first class following one another closely down New York harbour of an afternoon on their voyage to Europe; and, in travelling in them, it is interesting to find the little lever used to signal from the deck to the engine-room kept unaltered, at "full speed," for the whole of the voyage. The saloons, the music-rooms, the libraries, the smoking-rooms and their gorgeous decorations are all that could be imagined to make a voyage pleasant, and life at sea luxurious.

The route next in importance is that by the Suez Canal to the East, and to Australia, in which, as well as on the Atlantic route, other nationalities compete, with subsidised vessels. The traffic has not yet justified so high a speed, nor vessels of such magnificent proportions. But they are gradually being constructed on improved types, as well as the steamers to the Cape of Good Hope. We have already received replies to letters from London to the interior of India within a month.

And we may hope, ere long, to go regularly to the Cape—6000 miles—in a fortnight; and 12,400 miles from London to Sydney, by sea, in five weeks, and by way of Brindisi in a month.

Liverpool to Calcutta by the Cape being 11,380 miles, and Liverpool to Bombay by the same route 10,530 miles, it would seem likely that as better steamers are built to make these passages in less time and with more comfort, there may be a chance of the partial revival of the use of the long sea-routes. The Canadian Pacific route by Vancouver, and the American route by San Francisco also offer opportunities for competing with the Suez Canal route to those who have business in North America, or who do not object to the railway journey across the American continent, on their way to China, Japan, and Australia. The distances *viâ* Vancouver are: Liverpool to Hong-Kong 11,649 miles, and Liverpool to Sydney 12,663 miles.

The greatest amount of trade done by the United Kingdom in any one year, appears to have been in 1890, when the exports and imports together reached nearly £749,000,000, exclusive of bullion. In 1894 the total trade was £682,000,000; in 1895, £702,500,000; and in 1896, £738,000,000. In 1836 it was £125,000,000. It is satisfactory to learn that about 72 per cent. of that trade is carried in British vessels, the same proportion obtaining for the world's traffic carried in British vessels through the Red Sea. The total imports into the United Kingdom for 1895 were £416,689,658, of which £95,530,210 were from British possessions; and the total exports of the United Kingdom for the same year were £285,832,407, of which £76,072,151 were to British possessions. Such are the splendid results as regards the United Kingdom of existing means of communication by land and sea. They are due mainly to the sense of security in Great Britain for the employment of capital, which has gradually been established, and is now universally experienced by those who conduct the world's business. An American statesman lately expressed his opinion that the pound sterling is the basis of British prosperity. In any case, the gross revenue, raised more easily in the United Kingdom for the year just closed, was £112,000,000, against £52,500,000, raised with far greater pressure, in 1836; and it would be most disastrous, not only for the British Empire, but also for the world, if the confidence and credit now attaching to British commerce, and to British naval power, were in any way to be undermined.

The geographical communications of the world for the exchange of *information* comprise as regards (1) postal work: (*a*) letters, (*b*) post-cards, (*c*) newspapers, (*d*) book packets, (*e*) parcels; and as regards (2) telegraph work: (*a*) cable messages, (*b*) telegraph messages, (*c*) telephone conversations.

The United States is far ahead of other nations in its postal, but more particularly in its electrical, activity of communication. The genius of the working community in that country lends itself to restless activity, and the distances are so great that time cannot always be afforded for written questions and replies. The numbers of despatches by post of all kinds were by the latest returns 10,394,000,000 for the

United States, with a population of 64,000,000, against 2,907,000,000 for the United Kingdom, with a population of 37,750,000; 2,157,600,000 for the German Empire, with a population of 49,430,000; 1,951,000,000 for France (including Algeria), with a population of 38,350,000; and 481,600,000 for Russia in Europe, with a population of 93,000,000. These give per head of population, 162·4 for the United States; 77 for the United Kingdom; 43·6 for the German Empire; 50·8 for France and Algeria; and 5·2 for Russia in Europe. As regards the use of the telegraph, after the United States come the United Kingdom, France, Germany, in the order of activity.

Taking the United Kingdom alone, the numbers of letters have increased in ten years from 1,403,500,000 to 1,834,200,000; the numbers of post-cards in the same time from 171,300,000 to 314,500,000; the numbers of book-packages from 342,200,000 to 672,300,000; and the numbers of parcels from 32,860,000 to 60,527,000; but the numbers of newspaper packages only from 147,700,000 to 149,000,000. The numbers of letters would, of course, increase very much more if a universal penny postage were to be introduced, as they did after the penny post was established for internal purposes in 1840.

The electric telegraph was first constructed in 1838, and the first submarine telegraph in 1849. Since those dates the civilised world has been furnished with a nervous system of 5,000,000 miles of telegraph wires, the ocean has been supplied in all directions with upwards of 160,000 miles of submarine cables, and the principal nerve-centres have been provided with telephones. In American houses it is quite common to insert apparatus by means of which the opening of a door or window, or the attempt to open a fastening, causes a bell to ring in the bedroom of the proprietor, and warns him of the locality which has been interfered with.

In conclusion, the moral of the foregoing historical *précis* is very simple and very obvious, and we are now fully able to appreciate it by the light of ample experience. The world's resources can be properly developed only by freedom of, and facilities for, inter-communication; and in each particular country the same law holds good. In proportion to the cheapness and rapidity with which passengers and freight can be profitably conveyed, and information exchanged, so is prosperity attained, civilisation promoted, and knowledge increased. The larger the area, the better the result. On the other hand, selfish attempts at monopoly—crabbed regulations in restraint of freedom for traffic and transport—censorship of public or private written or telegraph communications—the imposition of high protection duties—passport annoyances, are all practical mistakes, are seriously disadvantageous, and tend, sooner or later, to recoil on those who unwisely indulge in them. Subsidised industries, bounty-fed branches of business, and other unnatural sources of temporary prosperity, only act by way of stimulus in producing artificial results, and ultimately combine against the public and private weal. In any case, the most valuable elements of education which we can imbibe ourselves and impart to our children are (1) the avoidance of every wrong principle, scientific, artistic, mechanical, industrial; (2) the

advantages of absolute freedom—of intellect—of contract—of traffic and commerce—of mind and body; (3) the supremely valuable influences of true religion, of which the essence is charity. It is impossible to summarise the progress of the present century, and especially of that part of it which forms the Victorian Era, better than by quoting the words spoken to Daniel 2430 years ago—"*But thou, O Daniel, shut up the words, and seal the book, even to the time of the end:* MANY SHALL RUN TO AND FRO, AND KNOWLEDGE SHALL BE INCREASED."

LORALAI.

By Major A. C. YATE, 2nd Baluchistan Battalion.

I SELECT Loralai as the heading of my paper rather because I have been living there for the last sixteen months, than because I propose to confine myself exclusively to the limits of its immediate surroundings. What may be said of Loralai may be said of very many other parts of Baluchistan; and as, during the last seventeen years, I have seen a good deal of that frontier province, I do not feel that I can so dissociate myself from the rest of it as to be able to concentrate my ideas solely on Loralai. Not that Baluchistan in its length and breadth presents no variety of life and feature; still, with this variety underlying it, there is a general uniformity in the nature of the country, the people who inhabit it, and the life they lead. Whether it be the sand-hills of the Registan, or the rugged mountains of Zhob and Makrán, each district has its stamp of barrenness. Go where you will, you find the nomad and the villager; and both alike are ready to turn from the ways of peace to plunder their neighbour or defend their own possessions.

My first visit to Loralai was in January 1889. My regiment remained there till April or May of 1891, and for some twelve months of that time I was with it. I next visited Loralai in December 1895, and was stationed there till very recently, when I moved to Chaman, the charms and drawbacks of which Captain M'Mahon very briefly summed up in his recent lecture, before the Royal Geographical Society, on "The Southern Borderlands of Afghanistan." If I can succeed in making "Loralai" an interesting subject, I think, some day, I should like to enlarge a little on "Chaman."

There is a sound in the name of Loralai that forbids it to be dismissed abruptly. When first heard it awakens memories of the Lürlei of the Rhine; but the name, when analysed, presents no romantic elements. It is said that the late Sir Robert Sandeman was asked, some twelve years ago, when the cantonment of Bori was about to be founded, to provide a name for it. He suggested "Loralai." The name is felicitous and appropriate. In the first place, its sound is attractive—more than the place itself at first sight, many would say; and, secondly, it possesses a geographical and etymological fitness. "Lora" means "river-bed," and "lai" means "tamarisk." The river-beds of Baluchistan—and those of

the Bori valley are no exception—are nurseries of tamarisk; and when the purple-red blossom is on them they are pleasant to look upon. Bori is the native name of the valley in which the Loralai cantonment stands; and Bori it will be to the native when Loralai is a ruin, for the lives of these frontier cantonments are not long. Shikarpur and Sukkur, which, in the years following Sir Charles Napier's conquest of Sind, were important cantonments, no longer present, to the best of my belief, a vestige of their old lines and barracks. Rajanpur is abandoned; Jacobabad is but a wreck of its old self; and ere long the garrisons of Dera Ghazi and Dera Ismail are likely to be pushed forward into Waziristan, nearer to the new frontier which, under the Durand treaty, has been demarcated from Chitral to Sistan. Loralai may follow suit; but in the meantime it is needed to overawe the surrounding tribes, notably the Marris. The murderous attack of some six or seven Marri fanatics on the Sunari station of the Sind-Pishin railway, in October 1896, will be still fresh in the memories of all those who feel interest in this part of the world.

From a scenic point of view the country surrounding Loralai is but an expanse of stony valley hemmed in by ranges of rugged barren mountains. The valley is studded with a few villages, and a few square miles of cultivated land. I take the whole area of the Bori valley roughly at thirty by twelve miles. Within this area there is a very fair scope for study and observation. There is human, animal, reptile, bird, and vegetable life. There are some archæological traces. There are the climatic and meteorological phenomena. The careful study of the water of Loralai would, in these days when water is one of the *cruces* of medical science, be instructive, though probably not palatable. Every one who reads the daily papers is familiar with the principles of bacteriology, and the part that microbes and bacilli play in the breeding of disease. As often as not, water is the root of the evil. Every time that I looked at the water of Loralai, and the black slime that it deposited, a slime which when stirred darkened the water like a cuttle-fish, and sent forth a foul odour, I saw in it the practical disregard of all medical hygiene. It seemed to account for the fever that harasses the garrison from August to October. The Sepoy is an excellent judge of water, and our men had no good word for the water that the wells and *karez* of Loralai provided for them.

The word *karez* is so familiar all over the country lying between the plains of India and the Caspian (in Persia the word is *kanât*) that one half forgets to explain it. These Afghans, Baluchis, Persians and others are very expert at sinking their shafts along the lower slopes[1] of hills, or even in the middle of a valley, and striking the water. I doubt if the mystic water-finder with his divining-rod excels them in skill or inspiration. At Quetta the reward for striking a spring is Rs. 500 (£30); for failure, nothing. I am told the shaft is never sunk in the alluvial hollows, but always on the stony slopes. If the first shaft fails, a second is sunk from 500 to 1000 yards lower or higher on the slope. Once the water

[1] Called in Persian-speaking countries the *daman* or "skirt" of the hill.

is found, it is carried by an underground channel (with shafts to the surface at every twenty or thirty yards) to the village or cultivation where it is needed. This underground passage of the water, during at least the earlier part of its course, protects it from evaporation under the powerful sun, and also preserves its purity; though a study of the habits of the natives sends one away with the conviction that they subordinate the purity of the water to their own conveniences. One thing, however, must impress the resident or traveller in all these countries, notably Baluchistan, Afghanistan, Persia, and Central Asia, viz., the value and appreciation of water. On it, in the first place, depends the welfare and prosperity of the people. It is not land that is of value, as in countries where Nature sends a rainfall of forty inches or more per annum. It is water alone that is inestimably valuable in countries where not one-tenth, or perhaps one-hundredth, of the soil can be cultivated. It is needful to travel in these arid, sun-scorched countries to know what the luxury of a draught of pure cool water means. It is only then that one can feel in sympathy with the rapture that inspires the verse of a Persian poet, as he sings of wood and water. It is years since I puzzled out the poems of Saadi and Hafiz; but I still remember the little road-side runlet near Shiraz, and the shady trees that bordered it, which Hafiz has handed down to fame. It was a hot June day when I drank of the runlet, and rested under the trees. There are ice-cold springs in the mountains south of Shiraz, and on the road from Meshed to the Caspian, from which I have drunk, and in which I have cooled my hot head in the mid-day heat of June and July; and never shall I forget them. No more shall I forget the very excellent pump spouts from which, years ago, I refreshed my boyish lips after a day of varied exercise, such as boys only can indulge in. We had never heard of microbes or bacilli in those days, and filters were, to us at least, unknown. It has been for science to discover that, in inventing filters, it invented the most prolific breeding-ground of the germs of all diseases. There is nothing poetic, and nothing, it seems, sanitary in the flat water of a filter. There is health, if not poetry, in the cool draught from the pump spout; and water as Nature made it, in spring, rill, brook, rivulet, and great river, has been from the earliest days of literature the very source and fount of poetry. Give me water as Nature made it, and I leave all filters and bacilli to science. I have seen bad water enough in my time, in the Pishin valley, on the roads from Chaman to Kandahar, and from Lash-Jowain to Herat, on the southern borders of the Registan, in and around the Great Kavir or Persian desert, and elsewhere. I can dismiss them as an unpleasant experience. It is less easy to forget the horrors of the Indian barrack filter, as pictured a year or two ago in the columns of the Indian press. At one camp in the Baluch desert the water (in 1884), being full of worms, had to be strained and boiled. Better this known evil than the veiled impurity of a filter, which is a hot-bed of microbes.

The native of Baluchistan shows no mean skill in the distribution and utilisation of the water at his disposal. I have already referred briefly to their methods of sinking shafts in search of springs, and to the way in which the *karez* is made. (In the damp and shade of the *karez*

the maiden-hair fern flourishes.) That they manage their levelling skilfully the water-channels are proofs in themselves. I am told that a fall of six inches in a mile is as much as a canal will stand without scouring. These Pathans and Baluchis carry their water for miles in small channels, and so control the level that there is no under rapidity of flow. At the same time, of course, their irrigation engineering wants the exactness and finish of that of the scientific engineer. The banks are weak and tunnelled through and through by rats, and if heavy rain falls give way here and there and let the water run to waste. In this respect the Pathan and Baluch cultivator is very careless. A spade in time would often save thousands of gallons. Where water is so valuable and so frequently the subject of dispute and possibly bloodshed, this callousness to waste is, to say the least, inconsistent. Water and women, I have heard said, are at the root of all disputes in this country. The distribution of water for irrigation is arranged with due exactitude. In some cases it is regulated by time, each cultivator getting the water for a fixed time daily, or every second day and so on. Another system, I am told, is to build a dam across the channel, and then cut V-shaped sluices in it, apportioning to each his allotted quantity. A mile out of Loralai is the best bit of irrigation engineering I have seen in this country. A channel is carried under the bed of a torrent more than 100 yards broad. It disappears on the right bank and bubbles up and runs away afresh on the left. How the underground channel was made, and how it is shored up (a torrent, four or five feet deep, 100 yards broad, and running five or six miles an hour, rushes above it after heavy rain) is more than I could ascertain. I have heard of the frontier tribes carrying their channels by tunnelling right through solid rock, but I have never seen such work.

I have been led, I might almost say unwittingly, into a long excursus on water. My only excuse must be its importance in the country I am writing of. To any one who has travelled and lived in these parts, water infallibly revives a host of memories, delightful and disagreeable. I must just allude to the way the streams have of losing themselves underground for a few miles and then coming to the surface again, and to the dangerous prevalence of quicksands here and there. During the Afghan War of 1878-81 the fords of the Pishin Lora were marked out with stakes. In 1884 near Herat I rode with another officer straight into a quicksand in a narrow ravine, where no thought of a quicksand suggested itself. We and our horses struggled out with difficulty. As for qualities of water, I have come across much that was unsavoury, but nothing so repulsive as the waters of Harrogate, or quite equal to those of Godar-i-Shah as described by Sir Charles M'Gregor.

Live and travel as one may in these countries, it is most difficult to get to know the inhabitants well. Few of us can converse with ease in their languages, and they have a natural reserve that has to be disarmed. The sound of his own language brings a smile to the face and unloosens the tongue of many a Pathan. How it affects a Baluch I know not, for I do not speak Baluchi. The inhabitants of the Bori valley are Kákar Pathans. Round about are the Marris, Lunis,

and other tribes. The nomads who frequent the valley in spring and autumn are known as Ghilzais, Nasirs, Kharotis, etc. For detailed accounts of these tribes and clans I must refer to Bellew's *Races of Afghanistan* and Oliver's *Pathân and Biloch.* I can only say of them what I see myself. Either they are owners of large flocks of sheep and goats, or they are breeders of camels. They live under awnings of black haircloth, supported on poles five to seven feet high. In these are housed men, women, children, dogs, and flocks. The camels, to the best of my knowledge, stay outside—though the tender young ones are probably

GROUP OF PATHANS.
WITH TENTS IN THE BACKGROUND.

brought inside in inclement weather. These tents are called variously *kegdai* (in North and East Afghanistan) and *gezhdai* (in South and West Afghanistan). The nomads, of course, winter at low and summer at high levels. Often they pass from Afghan to British territory and *vice versâ*—a habit that meets with no favour in the eyes of the Amir Abdurrahman Khan, but one which he cannot effectually check. The sheep- and goat-owners make their money by the sale of milk, *ghee*, wool, and certain fabrics of hair and wool probably manufactured by the women. The camel-owners presumably realise by the sale of the young stock and possibly of camel-hair fabrics—but of this I know nothing for certain. I do know that in Central Asia the manufacture of camel-hair cloth is a very valuable one. The best qualities are perfect in their strength and fineness and sell for about a *toman* (7s.) a yard. The coarser qualities are very durable—camel-hair saddle-bags last for ever. In contrast with these nomads, the settled residents of the Bori valley live in low mud houses enclosed in walls. They, too, own sheep and

goats, also some cattle, donkeys, and a few poor specimens of equine stock. They cultivate the country round the village, the crops being principally barley and wheat. The law of the country forbids these settled races to have arms, but the nomads are all armed. It is an interesting and rather comic sight to watch the camel-breeder's migration. The number of camels, from old to infantile, may be anything from fifty to five hundred; but will certainly straggle over a distance of one to two miles. Camels interspersed with cows, donkeys, ponies, watch-dogs, men (with swords and pronged flintlocks and quaint powder-and-shot belts), women, and children form the line. The elder children straddle on bullocks and camels; the infants are, so to speak, buried among the loads, their towselled, half-shaven heads and naked shoulders alone protruding. I believe they do not get sunstroke.

Wild as these people are, their manufactures are often remarkable in their excellence, just as are the celebrated Turcoman carpets. The women of these Pathan and Baluch nomads produce very tasteful and delicate embroideries. Their husband's shirts benefit by it. I bought one off the owner's back. It took some washing. The women's dresses, too, are richly embroidered with silk. I had one of these made to order. Alas! the lining was that of another dress which must have seen months of wear. The owner explained to me that it was not the custom to wash dresses oftener than once in six or eight months. It is in this way that I have picked up some trifling knowledge of the ways of these peoples —and I just tell it to you as I learnt it. As a rule, these people are quite ready to meet the stranger who enters into conversation with them. Only now and again one encounters individuals whose dulness, reserve, or uncouthness of manners makes intercourse with them impossible.[1] At best, however, one can but see, so to speak, the outside of their lives—their out-of-door lives. It is the civil officer, to whose lot it falls to collect the revenue and mete out to them the awards of the law, who sees into their inner lives. Their appeals to the law are frequent, and as often as not, I am told, a woman is the cause. In Baluchistan still a large proportion of cases and disputes are referred to the tribal *jirga* or *panchâyat* for decision; indeed, were it not so the province could not be ruled by the handful of civil officers who administer it. The province is now in the transition state from non-regulation to regulation. In Sir Robert Sandeman's earlier days it was purely "Political." Now all the administrators carry double-barrelled official designations, for instance, "A.G.G. and Chief Commissioner," "Political Agent and Deputy Commissioner," and so on. In course of time the "Political" will drop out and the "Commissioner" be left. It will be in Baluchistan, as it has been in the Panjab and Sind—the military civilian will gradually make way for the covenanted civilian. The latter element is prone to

[1] I have had my experiences similar to those which Bellew describes in *From the Indus to the Tigris*, p. 180. Bellew judiciously blessed the rude, stolid Afghan. In November 1884 near Herat I passed several Afghan men and women working in the fields. Not one of them even looked up at me, or after me when I had passed. They had probably never seen an European before. This suppression of interest is a curious trait.

adhere more precisely to the formalities of law, and to be less partial to the *jirga* and *panchâyat*, which, indeed, are the outcome of that semi-independence which it is our policy (as of necessity) to accord to newly-annexed frontier tribes. The inhabitant of the plains of India has been our vassal for a century, has learnt to conform to or travesty our ways, and is none the better for it. The north-west frontier tribesman is still as his ancestors, not his annexers, made him.

It was not long ago that in my morning ride I came across the site of a dozen or more *gezhdais*. The floor of each was clearly mapped out. It was laid down in part with gravel and pebbles, and in part mud-plastered. In the centre was the fire-hole (the smoke escapes anyhow), and at one corner (the same in most cases) a slightly raised gravelled platform—whether for sitting, sleeping, or storage, I cannot say.

I must now leave the people of the country to say a few words of the fauna and flora. Some of my brother-officers would be able to entertain your readers, after the manner of the *Badminton Library*, with most interesting accounts of shooting the *gad* or *urizàl*, the markhor, the bear and leopard of Baluchistan, the hyæna, wolf, lynx, and other animals prized by sportsmen. I have done and seen little of this shooting. All these animals are getting scarcer now, as is generally the case where the British sportsman takes the field. On hills where the *gad* was found in numbers eight years ago, not one is now to be seen. Not that there are not plenty left. The markhor always frequents far more inaccessible heights than the *gad*. The hunter after *gad* and markhor now and again comes across the bear and leopard; but the numbers of each shot, to my knowledge, within the last eight years, may be counted easily on one hand. The cub of one she-bear thus shot was given to me on 6th May '96, and we took the greatest interest in him. He only lived, poor little fellow, to the age of three months; for two cowardly Airedales and a bull-terrier set on him, and in a brace of seconds so injured him that he died three days later, on the 13th of June. His little games and ways, his lolling gait, his gymnastic powers up trees, his gambols with our bull-terrier pup (no connection of the murderer), were intensely comical; and his silent endurance of pain and dumb pleading for relief in the last few days of his life were pathetic in the extreme. These are the two memories I have of him, the comic and the pathetic. Of the other animals we have harboured, I shall only give a list—a pair of hedgehogs, two young markhor, an infant hare, a tortoise, and a mongoose. Mongooses love eggs and break them in an original manner. Taking the egg in the fore-paws, they fling it behind them against a clod, stone, wall, or other obstacle, till it breaks. Then they eat the contents. Some of our pets were let loose, some died, and one escaped. The markhors apparently died of over-indulgence in green food. Our two terriers formed an intimate friendship with the hedgehogs, and always escorted them during their hours of exercise.

Besides those mentioned, the wolf, jackal, porcupine, jerboa, and a variety of house and field rats and mice, are the only animals I remember. The porcupine I never set eyes on, but its quills were found in scores round deep burrows. I spent seven hours on a hot day in June last year

getting a fox-terrier dug out of one of these deep burrows. He followed some animal, apparently a porcupine, for twenty feet or more into the labyrinthine windings of the burrow, and then, it seems, stuck fast. Our third boring luckily hit him off at a depth of seven feet, and very glad I was to see his nose at the hole. For four or five hours he could be heard barking and digging; after that all was silence, and I rather thought I should not get him out alive. The wolves of this district grow savage in the cold: three or four of them last year followed up an officer riding with his dogs, and were kept off with some difficulty.

Of the indigenous flowers I can only name the tulip, meadow-saffron, a species of orchid, and a small purple iris. Of trees and shrubs I can only mention tamarisk, wild pistachio, mulberry, apricot, vine, pomegranate, wild olive, willow, poplar, almond, wild fig, and palmetto. The last makes excellent torches, and provides material for thatching, matting, etc. The four date-palm trees at Kot, five miles from Loralai, deserve a few words to themselves. They are growing at an elevation of 4800 feet—as I believe, a very high one for date-palms—but their roots are almost washed by a warm spring which issues from the southern base of a high hill which completely shelters the palms from the prevailing cold NW. wind.

I see no object in detailing here a list of birds, most of which may be found in Mr. W. T. Blanford's (Vol. ii. of *Eastern Persia*) work on the Zoology of Persia and Baluchistan, and in Murray's *Birds of India*. The birds I saw were mostly migratory, passing south to India in the early winter, and northward again in early spring. Some, as two or three varieties of thrush, wintered with us. A flight of pelicans, ever circling onward, is not to be forgotten. A flock of glossy ibis came up the valley one day at sunset, dropping, straggling at intervals. Bad leadership I thought it. Why not have settled down earlier for the night's rest? The stragglers got shot. I ate one. It was very palatable. The dark purple and bright-green plumage was admirable, but lost its gloss after death. One or two choughs I saw. The natives praise them as delicacies of the table, but they praise other very fishy fowl that we do not eat. The yellow fat of the pelican is much prized as a curative for rheumatism. One other bird I must name, the paradise flycatcher. I only saw one pair; their striking plumage, long tails, and erratic darts of flight are not to be forgotten. In its third year the plumage becomes, and afterwards remains, white. It seems to be rare in Baluchistan. Blanford does not mention it, and Murray speaks of it only as "a winter visitant in Sind."

As regards archæology, I will commence by saying that the passage of Alexander has left its traces as well as in most other places between Persia and India, from Merv on the north to the Mekrán coast on the south. I have not Mr. M'Crindle's works here, and cannot say whether Alexander or any one of his generals did or not penetrate into the Bori valley. I know that near Duki, twenty miles south of Bori, old Greek coins are found and worn by the natives as ornaments. There are several mounds in the valley, the soil of which is chock-full of broken pottery. The most remarkable remain, however, is that on "Monastery Hill," so called from the idea that it is of Buddhist origin. The length of the enceinte

must have been some 500 yards. The walls are all built of loose stone (no mortar used) fitted together. On one side the wall is twelve or fifteen feet high, and the higher points were seemingly occupied by strong *sangars* or stone bastions. No garrison could have been safe unless it had a water-supply inside the fort, and there is a large loophole like the mouth of a choked-up well. There is nothing about the building suggestive of Buddhism, as far as I am aware. It has all the appearance of an old fortified place, and its position commands some seven or eight roads all concentrating on Bori.

If there is not very much to be said for the scenery of the Bori valley—and I admit that, except for the sunrise and sunset effects on the mountains, there is no beauty—that cannot be said of all parts of Baluchistan. In the first place, the grand cliffs of Khalipat, Takatu, Zargun, and other mountains are a sight to see, especially when snow-capped. The rifts, such as the Pil, Chappar (through which the Sind-Pishin railway passes), etc., and a score of ravines furnish wild and picturesque scenery. Ziárat and Chotair deserve a chapter to themselves. There the juniper clothes the hillside, and some of the ravines are beautifully wooded. One hardly wonders that in 1879 the contrast of its wooded slopes and glens roused some enthusiasm in the breast of Sir Robert Sandeman. There was no such enthusiasm, however, in the breast of a forest-officer, whom we met at Sharigh or Harnai in April 1880, fleeing from the "deodars" he had been sent to report on. They proved to be only juniper; but for fantastic devilment of form I defy anything to beat the juniper of Ziárat. The practical utility of the forest-officer found no charm in that. Forestry is not much of a success in Baluchistan. The best work seems to be done by the authorities in the cantonments. It will be some years, though, before even Quetta can show avenues like those I remember in Tashkent and Samarkand. The forest reserve in the Pishin has proved a failure (the trees will not grow), and is, I hear, being abandoned. The reservoirs there will, no doubt, come in useful for ordinary cultivation. Thousands of young trees are now put down every year in the cantonments of Baluchistan, chiefly poplar, plane, willow, and mulberry. All European fruits and vegetables flourish here. We have green peas and strawberries in abundance when they are worth their weight in silver at home. Baluchistan is a land of promise; if Nature would but give it a forty- or fifty-inch rainfall—which it will not. All must depend on peace, growth of population, and extended irrigation. What British rule can do for it will be done. Its frontiers have now been fixed with Persia by Colonel Holdich, and with Afghanistan by Captain M'Mahon. Cultivation and manufactures will be developed as far as means admit. Trade-routes will be maintained and opened. It is on the cards that in years to come the through railway from Europe to India may thread the valleys of Makrán. Certain it is that Baluchistan is a province which will play no unimportant part in the future history of our Indian Empire. It is well-nigh sixty years since the first Afghan war brought us first in contact with the tribes—Baluch, Brahui, Marri, Pathan, etc.—which now are included in that province. The siege of Kákar in the Marri country (about 1840) is almost an unique instance of a

British garrison being permitted by a wild frontier tribe to march out with the honours of war, and of the agreement being scrupulously respected and fulfilled. After the Afghan war and the conquest of Sind, a succession of commissioners in Sind, from Sir Charles Napier to Sir William Merewether, conducted our relations with these tribes till the advent of Major (afterwards Colonel Sir Robert) Sandeman. He was the founder of Baluchistan as a province of the Indian Empire.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Election of Members, etc.

At a Meeting of Council held on June 10th the following gentlemen were elected members of the Society:—W. G. D. Rodway, Glasgow; John French, LL.B., Edinburgh; and E. Wagner of Göttingen.

The names of fifteen members, whose subscriptions are in arrear, were struck off the roll.

Presentation of Books.

At the same meeting the following list of books, presented by private donors to the Library during the year 1896, was read, and the Council desires to record its thanks for these as well as for a large number of smaller publications:—

	Presented by
Bibliographic Sketch of D. Milne Home, LL.D., etc. .	Miss Milne Home.
The "Nemesis" in China. From the Notes of Capt. W. H. Hall, R.N.	C. S. Robertson, Esq.
A Voyage to the Pacific, performed under the direction of Captains Cook, Clerke, and Gore. 4 vols. .	Mrs. R. Innes.
The History of America, by Wm. Robertson, D.D. 3 vols.	,,
An Interesting Narrative of the Travels of James Bruce, Esq., into Abyssinia	,,
Specific Gravities and Oceanic Circulation (*Trans.*, R.S.E.)	Dr. Alex. Buchan.
Journal of the Royal Asiatic Society for 1896 . .	Coutts Trotter, Esq.
The Life of Captain Sir R. Burton, K.C.M.G., etc, by his Wife	The Trustees of the late Lady Burton.
Wasserverhältnisse des Schweizerischen Rheingebiets .	Prof. Paul Chaix.
The Meteorology of Edinburgh. Part I. (*Trans.*, R.S.E.)	R. C. Mossman, Esq.

The Diamond Jubilee.

A deputation, consisting of Sir Thomas Clark, Bart., Vice-President, and Dr. George Smith, C.I.E., Dr. J. J. Rogerson and Dr. John Kerr, Members of Council, represented the Society at the thanksgiving service, held at St. Giles' Cathedral on June 20th in connection with Her Majesty's Diamond Jubilee.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Geography at the Universities.—The Reports of the Lecturers on Geography at Oxford and Cambridge are rather more encouraging. At Oxford, Mr. Mackinder delivered during the year three courses of lectures on Central Europe, Britain, and the Far East. They were attended by forty-three undergraduates and eleven ladies in the Michaelmas term, by forty-one undergraduates and twenty ladies in the Lent term, and by twenty-four undergraduates and eighteen ladies in the Summer term. Mr. Mackinder also delivered a course of twenty-five lectures at Gresham College to 200 teachers, whose essays were examined by Mr. A. J. Herbertson. Twenty-eight lectures were delivered at the London School of Economics, which were attended by several students from foreign Universities. Mr. Mackinder gave shorter courses at Liverpool and in the Toynbee Hall, London.

Mr. Yule Oldham delivered at Cambridge the first part of a series on the Geography of Europe in the October term, the attendance being twenty-four. In the Lent term, when the second part was delivered, the attendance rose to thirty-seven, of whom eleven were ladies. Mr. Oldham also lectured on Physical Geography for geological students, and on the Scientific Study of Scenery. As a result of lectures for historical students, geography has been recognised as an essential subject in the revised Historical Tripos.

In August Mr. Oldham lectured to many hundreds of University Extension students on the Evolution of the Map of Africa, and last term gave a short course on the Teaching of Geography to teachers and students of the Cambridge Training College.

The success attending the above lectures has induced the Council of the University to make a grant of £50 for the purchase of geographical apparatus, to which Dr. Nansen has added an equal sum.—*Geographical Journal*, June.

Meteorology of Edinburgh in 1896.—Mr. R. C. Mossman has contributed a paper on the records of last year to the *Proceedings* of the Royal Physical Society. Remarkable deviations from the normal were, perhaps, not so striking as in the preceding year (see vol. xii. p. 586), but they were by no means absent. The highest barometric reading ever noted in Edinburgh, 31·072 inches, was recorded at 9 A.M. on January 9th. The next highest value during the past 127 years was observed on January 9th, 1820. The weather of the month was dry, sunny, and mild, and the temperature 4·4° above the normal. The warmth and high pressure extended over the following month, and the temperature through March, but the pressure reached its lowest, 28·299 inches, on the 3rd of that month. May, again, was remarkable as the warmest May since 1848, the driest since 1859, and the sunniest since 1882, while the mean barometric pressure was the highest since the record was commenced in 1769, except in the year 1836. The mean temperature of the first five months of the year was 45·8°, which was exceeded only in 1779 when the mean for the period was 46°. The rainfall also, 4·81 inches, was the least since 1805.

The latter part of the year was unsettled: October being very cold, with a mean temperature 4° below the normal, the lowest since 1817. November was a very dull month, and December still worse, having only ten hours of sunshine, or barely one-third of the average.

The highest shade temperature during the year was only 78·1°, occurring on May 11th. On the same day the greatest range of temperature, 33·2°, was recorded. The largest daily rainfall was 1·23 inches, on July 8th. The amount of sunshine was very small, being only 1052 hours, or twenty-six per cent. of the possible.

The Russian Census.—The first general census, taken on February 9th, is completed and a considerable part of the materials has already been transmitted to the Central Statistical Committee, which has published two tables. The first contains the population for each of the eighty-nine governments and provinces of the Empire, their areas, the density of the population, etc.; while the second gives a list of the capitals of the provinces, and all towns having a population of over 25,000. The previous censuses were made for fiscal purposes by the police and gave only the permanent residents and tax-payers. The general results are as follows:—

	1897.	1851.	Density per sq. mile.
European Russia (50 Governments), .	94,188,750	52,797,685	8·0
Poland (10 Governments), . . .	9,442,590	4,852,055	30·6
Caucasia (11 Governments and Provinces), ...	9,723,553	4,436,152	8·6
Siberia and Sakhalin (8 Governments and Provinces), ...	5,731,732	2,437,184	0·2
Steppe Region (5 Provinces), . .	3,415,174	...	6·5
Turkistan, Caspian Region, and Pamirs (5 Provinces), ...	4,175,101	...	1·4
Russian Settlers and Subjects in Bokhara and Khiva, ...	6,412	...	...
Total,	126,683,312	65,743,730	2·5
Grand Duchy of Finland, . . .	2,527,801	1,636,915	3·2
Total, Russian Empire, . . .	129,211,113	67,380,645	2·5

The density of population is highest in Poland (47·4 per sq. mile in Piotrkof). Next comes South-West Russia, with 29·7 in Podolia, and 28·8 in Kief; and Southern Russia, with 23·1 in Poltava. The population of the towns has increased rapidly, and there are now nineteen with more than 160,000 inhabitants each. St. Petersburg, including the suburbs, has 1,267,023; Moscow, 988,610; Warsaw, 614,752; Odessa, 404,651; Lodz, 314,780; Riga, 282,943; Kief, 248,750; Kharkof, 170,682; Tiflis, 159,862; Vilna, 159,568; Tashkent, 156,506; Saratof, 133,116; Kazan, 131,508; Ekaterinoslav, 121,216; Rostof, 119,889 (with Nakhichevan), 149,201; Astrakhan, 113,075; Baku, 112,253; Tula, 111,048; and Kishnief, 108,506. There are also thirty-five towns with a population of over 50,000, and sixty-nine more with a population exceeding 25,000.—*Geographical Journal*, June.

In the *Comptes Rendus* of the Paris Geographical Society, M. Venukof states that during the last five years the population of Lodz has increased by 160 per cent., of Riga by twelve per cent., and of Odessa by twenty-one. Moscow has received an addition of twenty-seven per cent., and has become the sixth city in Europe.

The Area of the Kingdom of Italy.—The results of a planimetric measurement of the areas of various parts of the kingdom, executed in 1896 by the Istituto Geografico Militare, are noticed in the *Bull. della Soc. Geogr. Italiana*, vol. x. Fasc. 4. The work was extended over those parts, excluding Sardinia, for which there was no satisfactory cartographic material when De Stefanis made his calculation in 1884. The area of Sardinia has been taken from the measurement made in 1884 on the map of La Marmora. The results are :—Continental Italy, 42,419 sq. miles ; Peninsular Italy, 49,877·75 (including the Republic of San Marino, 23·53 sq. miles) ; islands included in the administrative districts of the foregoing divisions, 143·1 ; Sicily, 9830·34 ; islands belonging to Sicily, 106·86 ; Sardinia, 9188·77 ; islands round Sardinia, 106·35. Total, 111,672·2 sq. miles.

The Highest Meteorological Station in the Balkan Peninsula.—Meteorological work has been extensively carried out in Bosnia and Herzegovina since these provinces have been occupied by Austria. Seventy-seven stations have been established, three of them being of the first rank, with registering apparatus. One of the latter is the high-level station on the summit of the Bielašnica, 6782 feet above sea-level. The observatory, standing at 43° 42′ N. lat. and 18° 15′ E. long., was erected in 1894. In 1895 the mean temperature was 32·9° F., and the decrease per 100 feet from Serajevo, 5348 feet below, was ·3°. For the coldest month, February, the mean was 13·3°, and 51·8° in the warmest month, July. The absolute extremes were −16·2° in February and 67·3° in July. The precipitation during the year was very large, namely 90½ inches, whereas at Serajevo it was only 35½. On the 18th of May there was still snow near the observatory, 3 to 5 feet deep. The amount of moisture on this summit is very remarkable.—*Geographische Zeitschrift*, Jahrg. 3, Heft 6.

The Greeks.—Herr A. Oppel has chosen the right moment to discuss, in *Globus*, Bd. lxxi. No. 16, the Greek race, its number, distribution and origin. The Count Capo d'Istria said that the Greek nation consisted of those men who, since the conquest of Constantinople, had not ceased to confess the orthodox faith, and to speak the language of their fathers, and had remained under the spiritual or temporal jurisdiction of their Church, no matter in what part of Turkey they might be living. But this definition is not satisfactory ; for there are Greeks, few in number certainly, who no longer speak Greek, while there are others who do not belong to the Orthodox Church, and still more who do not dwell within the limits of the Turkish Empire. On the other hand there are many who in language, religion, and national feeling, are Greek, and yet are not of the ancient Greek race.

It may be said in general terms that the Greeks inhabit the coast-lands of the eastern basin of the Mediterranean, and number altogether some 5,000,000 souls. They may be considered in two divisions—the Greeks in Greece, and the Greeks outside the limits of the kingdom.

According to a recent census the population of the Kingdom of Greece amounts to 2·42 millions ; but these are not all of Greek origin. The first foreign element was brought in by the irruption of Slavs at the end of the sixth century. In the towns, particularly on the coast, and in some not easily accessible mountain regions, the Greeks held their ground. In the Peloponnese, on the other hand, Slavs were so numerous that the peninsula was for a long time called Slavinia, but from the beginning of the ninth century they began to yield to the superior culture of the Greeks, and became so thoroughly Hellenised that only some place-names in the lowlands, and the fair type common in some districts, now indicate their presence.

The eastern part of central Greece and the islands were not affected by the Slav invasion.

Before the Slav language had quite vanished a new immigration occurred—that of the Albanians, who in the thirteenth century spread peacefully over Greece as far as the Peloponnese. Though to a great extent Hellenised and being gradually absorbed, the Albanians have in considerable fragments retained their racial character, especially where they settled on unoccupied lands, as in Argolis, Megara, and Attica, where they appear as agriculturists and semi-nomad herdsmen. At the present day they number about 224,000, of whom 90,000 live in the Peloponnese, forming 12·3 per cent. of the population, and in Argolis as much as 55·6 per cent. In central Greece there are 84,000 Albanians, and 50,000 in other parts of the kingdom—southern Eubœa, north Andros, etc. Though constituting a ninth of the population of the entire kingdom, they are not a source of weakness, being thoroughly Greek in their sympathies, and generally understanding the Greek language.

The Turks, who came in at the time of the conquest, and were mostly land-owners, have almost entirely disappeared since the Turkish yoke was thrown off. The Vlachs, on the contrary, descendants of the Romanised people of the Balkan peninsula, live in considerable numbers in the mountains of north and central Greece. The number of this people, called by G. Weigand Aromunes, is at most 50,000. Formerly the Aromunes, of whom there are 150,000 in the south-western part of the Balkan peninsula, Greece included, were champions of the Greater Greece policy, but since the Bulgarians have obtained their freedom, the Aromunes also have fostered a national feeling. In Greece, however, the well-to-do classes are opposed to the movement, and here, too, the Government has made great efforts to win over this people, which probably will be attended with success. Lastly, Gypsies must be mentioned, who are numerous all over the country. They are to a large extent Hellenised, and their numbers therefore cannot be exactly ascertained.

To sum up, there are in Greece about 500,000 persons of distinctly foreign origin—Albanians, Italians, Vlachs, Gypsies, and the ever-present Jews—while the remaining two million inhabitants are pure Greeks, or Hellenised Slavs and Albanians, or of mixed race, so intimately fused together that the numbers of each class cannot be determined.

On the Balkan peninsula Greeks occupy all the coast-lands, cutting off the Slav and Albanian inhabitants from the sea, and conducting the traffic with the outer world. From Kaliakra point, north of Varna, to the Gulf of Saloniki they line the coast, penetrate inland up to Adrianople, where they form a fourth of the inhabitants, and occupy the whole peninsula of Chalcidice. They have spread over the Macedonian plain to the foot of the mountains, and people the islands of Thasos, Samothrace, Imbros, Lembos, and Hagiostrati. In Epirus the distinction is not one of race but of religion; the Christians under the name of Greeks are opposed to the Mohammedan 'Turks.' The number of Greeks in the peninsula outside Greece itself has been estimated variously from 1·32 to 1·46 millions. In Crete, where the inhabitants are almost entirely of Greek race, and number perhaps 237,000, about 70 per cent. are Christians and 30 per cent. Mohammedans.

In Asia Minor the Greeks live principally on the coast, being found inland only in the neighbourhood of Trebizond. All the west coast, with the exception of a few small tracts, is peopled by them, and in Samos they have enjoyed autonomy since 1832, the Turkish authority being exercised only in the choice of a prince from the Greek house of Karatheodory, and in levying a tribute. Within the Turkish territory of Asia Minor there may be perhaps 850,000 Greeks, but it

is impossible to obtain exact figures. They may be divided into three groups. Those living on the west coast and the islands of the Ægean exhibit many characteristics of the ancient Greek type; those of the north coast and the interior closely resemble the Armenians, while on the south coast a Semitic type is strongly marked. Many of the Greeks living in the interior have lost their language and now speak Turkish, and some, outwardly at least, profess the Mohammedan faith. But whatever language they speak, they are the best educated, most progressive, active, and prosperous of all the peoples of the Levant, and are gradually ousting the Turks from their lands.

On the cession of part of Armenia to Russia many Greeks passed under Russian rule, and besides these there are about 55,000 of this race in the Caucasus, a large number in the Russian Black Sea ports and South Russia, and a considerable colony in Egypt. Lastly, 15,000 of the inhabitants of the Apulian peninsula retain the Greek language, costume, and customs, being descendants of colonists who settled there between the sixth and tenth centuries; and the town of Carghese in Corsica is inhabited by Greeks whose forefathers fled from the Peloponnese in 1676.

ASIA.

Great Britain and China.—On June 5th a new agreement with China was signed, by which Great Britain obtains compensation for a breach of the treaty of 1894. It may be remembered that the Shan States of Kiang-hung and Mong-lem were ceded to China with the proviso that they were not to be transferred to any other Power. Nevertheless, in 1894 the part of Kiang-hung which lies east of the Mekong was ceded to France. As compensation for this direct breach of the agreement, China has now handed over to Great Britain the Shan State of Kokang, which is not less in area than the district wrongfully transferred to France, and has also granted a perpetual lease of a tract on the Burmese frontier south of the river Nam-wan. China agrees not to exercise authority of any kind whatsoever in this territory.

Besides these frontier regulations, the treaty also contains provisions relating to commerce. If China should ever make railways in Yunnan, they are to be connected with the Burmese system, and whereas the trade between the two countries has been legalised only at Manwyne and Sansi, resort may now be had to any other advantageous routes. British consuls may be stationed at Ssumao and at Momein or Shun-ning-fu.

Stringent orders have been issued to the Governor-General of Kwang-si and Kwang-tung to bring *likin* duties within the limits of the treaty dealing with the navigation of the Si-kiang, so that the opening up of this river will perhaps be a reality.—*The Times*, June 9th.

The Si-kiang.—On February 17th a convention between Great Britain and China was signed, by which the boundary between Yunnan and Burma was determined, China ceding the territory beyond the Irrawaddy, and also agreeing to throw open the Kwang-si to foreign trade. Foreign steamers will be allowed to ascend the river to Wu-chau-fu. The account given of the river by M. Imbault-Huart, French Consul at Canton, is therefore of especial interest at the present time (*Bull. de la Soc. de Géogr. Comm. de Paris*, Nos. 1-3, 1897). The Canton river, Si-kiang, or West river, is formed by three considerable streams—the Tung-kiang, or East river, flowing from the southern extremity of Kiang-si, the Pei-kiang, or North river, descending from the Mei-ling mountains, and the Si-kiang, the largest of the three, on which Wu-chau-fu is situated. This river is joined at

Sin-chau-fu by the Hung-chwei-kiang, or river of Red Water, flowing from the borders of Kwei-chau and Yunnan, and above the confluence it has a south-westerly direction. Above Nan-ning-fu the river is formed by the Yu-kiang, or Right river, which has its sources in Yunnan, and the Tso-kiang, or Left river, which flows from Cao-bang and Lang-son.

The Hung-chwei-kiang has never been thoroughly explored by Europeans, and the question whether it is the main stream of the West river remains therefore unsettled. At Tsien-kiang, a little above Nan-ning-fu, it is 90 or 165 yards broad, according as the river is high or low, and accordingly it has only half the breadth of the Yu-kiang at Nan-ning-fu. Navigation stops a few miles above Tsien-kiang. It is, therefore, difficult to believe that the river has the length usually assigned to it on Chinese maps, and it may be assumed in the meantime that the main branch of the Si-kiang is the one flowing from the south ; and this is in accordance with the Chinese description of the province of Kwang-tung.

The Yu-kiang, one of the streams forming the Si-kiang, has been explored by Colquhoun, Bourne, and other travellers. Rising in the department of Kwang-nan, in Yunnan, it flows at first southwards, and then, turning to the east, enters Kwang-si. At the boundary of the provinces stands the village of Po-ngai, remarkable only as the limit of navigation, where merchandise for Yunnan is transferred to the backs of animals. Between Po-ngai and Po-se, some forty miles lower down, is a series of rapids and narrow passes, which render navigation difficult. The fall of the river is about forty inches a mile. The light boats used on this part of the river are manned by Shans, who are the inhabitants of the country. They make the passage down stream in about two days, and in three going up. Po-se is an important centre for the exchange of the opium of Yunnan and Kwei-chau, valued at £160,000 a year, for foreign goods—cotton and woollen fabrics, cotton thread, matches, petroleum—brought up the Yu-kiang. As boats of a certain tonnage cannot proceed above Po-se, their cargoes are here transferred to the small boats already mentioned. The distance from Po-se to San-kiang-ku, the confluence of the river with the Tso-kiang, is 150 miles, and the fall of the river twenty-two inches per mile. The journey is accomplished in eight days with the stream, and twelve to twenty in the contrary direction, according to the direction of the wind and the height of the water. The banks of the river present a great variety of scenery—ravines with precipitous walls, and plains skirted by hills on the horizon. The region is poor, producing principally rice, sugar, aniseed, and tobacco, and a large part of the land is not cultivated. The miserable villages of the Shans are few and far between, and for days together the traveller does not see a single human being. The river forms a large number of rapids, and, when the water is high, is rapid and impetuous.

The Tso-kiang is formed by two streams rising within the Tonkin territory—the Ping-ting-ki, or Li-ki-chwei of the Chinese geographers, identical with the Song-ki-cong or river of Lang-son ; and the Ki-y-ki, which is the Song-bang-giang or river of Cao-bang. The two rivers join just within the Chinese boundary at the town of Lung-chau, which was opened to French commerce by the treaty of 1887. The Song-ki-cong is navigable by quite small boats to That-ke, north of Lang-son, and by larger boats only to Na-cham, a little farther down. By this route the journey from Lang-son to Lung-chau may be accomplished in three days, but boats laden with merchandise take a longer time, and on this river, as also on the Song-bang-giang, are sometimes during drought unable to pass at all. The road is a more direct and expeditious means of communication, and by it the journey may be made on horseback in a day and a half.

Lung-chau is a small walled town pleasantly situated on the north-east side of

a circular valley on the right bank of the Tso-kiang. Its population is 20,000, composed of Chinese from the neighbouring provinces, with an admixture of Shans. The market is held nine times a month for animals, and as frequently for meat, vegetables, and cereals. The commerce of the town is almost entirely in the hands of Cantonese merchants, and its value amounted in 1895 to about £14,500. The imports are false gambier, timber, Chinese aniseed, cardamom, and hides; and the exports opium, ground-nut oil, pottery, and household utensils of iron, sugar, and a small quantity of tea.

Up to the present the Lang-son railway has been of no service to Lung-chau. No one has tested the advantage of the route through Lang-son and Na-cham, and the native trader, ignorant of the customs regulations in Tonkin, and fearful of getting into trouble by transgressing them, is not inclined to obtain his goods from this direction. No one has hitherto taken the trouble to find out whether merchandise can be carried to Lung-chau more cheaply by Tonkin or Pakhoi. A concession, however, has been obtained from the Chinese Government by a French company for a railway from Lang-son to Lung-chau, which will place the town in direct railway communication with Phu-lang-thuong, and this will probably have a beneficial effect on the trade of Tonkin with southern China. From Hong-kong goods can be conveyed to Lung-chau through Pakhoi, and thence partly by boat, partly by portage, in twenty to twenty-five days, and from Canton up the river in thirty to forty days; whereas from Hong-kong to Lung-chau by the Lang-son railway and the Song-ki-cong the time of transit is seven or eight days, and will be shortened by two or three days when the projected line is completed. Time, indeed, is of little importance to the Chinese, and therefore the cost of transport is more important, which, on the basis of the present railway tariff, will probably be reduced by four-fifths. Moreover, by the convention of 1887 the duties on goods entering China by the Lang-son route will be reduced by three-tenths. But, after all, it is doubtful whether the trade with the province of Kwang-si, comparatively poor and badly cultivated—in many parts lying waste—is capable of much development.

The voyage from Lung-chau to Canton can be made in flat-bottomed passenger boats in twenty-five days on an average. As far as Nan-ning-fu the country is monotonous, the inhabitants being few, and little cultivation being visible. Nan-ning-fu is a town built almost entirely of brick, and contains 35,000 to 40,000 inhabitants—Chinese and Shans. It is the head of the Pakhoi trade route, and, after Wu-chau-fu, the busiest town of Kwang-si. Below, navigation is difficult owing to the numerous and formidable rapids. The villages become more numerous, especially below Sin-chau. Wu-chau-fu is the centre of a considerable traffic in rice, ground-nut oil, indigo, wheat, sugar, etc., cinnamon from the neighbourhood of Yung-hien, to the south of Wu-chau-fu, and opium from Yunnan, and receives salt, native stuffs, and foreign manufactures from Canton. It is the terminus of navigation in large boats. The depth of the river from this town down to the mouth is on an average twenty to thirty feet, but is very variable, the sounding-line reaching the bottom at six or seven feet in some parts of the channel, from November to March. It may be affirmed that steamboats, drawing no great depth of water, can ply to Wu-chau-fu, and, indeed, in winter this part of the river is navigable only by steamers or specially constructed vessels.

Corea.—*The Geographical Journal* for June gives a sketch of a journey made in the autumn of 1895 by Mr. Willis of the British Consulate in Seül, and the Rev. S. O. Warner, through a part of Corea not hitherto visited by Europeans. The route led through the province of Kang-wön considerably to the west of the

main road from Seül to Wön-san followed by former travellers. Fifteen miles from the capital Messrs. Willis and Warner came to a succession of confined valleys enclosed by steep, well-wooded hills. The northern branch of the Han river, down which a considerable quantity of grain is transported, was crossed repeatedly. The Kang-wön province was entered by a pass about 1200 feet high, and beyond the well-cultivated plain of Chun-chön hilly country was reached again. In the wider valleys are small country towns where fairs are held two or three times a month. Evidences of prosperity were not wanting, and British piece-goods were in demand. The country, however, is totally destitute of roads. Parallel to the east coast is a chain of mountains of an average height of 2500 to 3000 feet, which were crossed in two days. The scenery was wild and varied, and the hill slopes were covered with forests of oaks, pine, and maple. Monks, who have several large monasteries in the district, are the only inhabitants, except a few hunters and wood-cutters. After reaching the coast the travellers struck inland again to the Diamond mountains, and, falling in with the route traversed by Mr. Campbell in 1889, followed it to Wön-san. This part was in a flourishing condition in 1895 owing to recent discoveries of gold in the Han-giung province. *Geographical Journal*, June.

AMERICA.

The Canadian Hudson Bay Expedition.—The s.s. *Diana*, carrying the Canadian Government Expedition to explore Hudson Strait and Bay, sailed from Halifax, Nova Scotia, on 3rd June. The expedition is under the general command of Captain Wakeham, of the Department of Marine and Fisheries, but among its members are James Fisher, M.P.P., representing the Governments of Manitoba and the North-west Territories, and Dr. Robert Bell and Mr. Low, of the Geological Survey of Canada.

Dr. Bell, it is expected, will survey the southern parts of the Southampton group of islands, and the south coast of Baffinland from Fox Channel eastward to Big Island, about the middle of Hudson Strait. He will then be picked up by the *Diana*, and carried to St. John's, Newfoundland, calling probably at Cumberland Sound. He is expected to reach St. John's by the 1st of October. The *Diana* carries a yacht and row-boat with a crew of sailors, to enable Dr. Bell to make a topographical and geological survey of the coasts mentioned. He is also provided with a good photographic outfit, and expects to obtain many views of the picturesque lands to be visited.

While these operations are in progress, Mr. Low will explore part of the south side of Hudson Strait, and Commander Wakeham will cruise in the Strait and Bay, inquiring into questions affecting the navigation of these waters, and testing their fishing capabilities. We anticipate many interesting and important results from this expedition.

The Bermudas.—This group, called also the Somers Archipelago, has been investigated by many geologists and others, especially by Sir Wyville Thomson and Professors Rice, Heilprin, and Agassiz, who have expressed very different opinions regarding the geological changes it has undergone. Being puzzled by their want of agreement, Professor J. J. Stevenson visited the islands to form his own conclusions, which he has made known in the *Trans. of the New York Academy of Sciences*, vol. xvi.

The Bermudas, lying 660 miles from the nearest land in lat. 32° 20′ N. and long. 64° 45′ W., form an elliptical area of about 220 square miles, with its major axis running roughly north-east and south-west. Most of this area is under water

even at low tide, the land lying at the south-eastern side of the ellipse, and consisting of 365 islands with an aggregate area of barely twenty square miles. Arranged in the form of a large fish hook, they enclose several sounds, bays, and harbours, some wholly landlocked and all deeply interesting to the geologist. The point of the hook in the south-west is formed by the islands Ireland and Somerset, then follows Main or Hamilton, while St. George and St. David, with numerous smaller islands, represent the broad top of the stem. Hamilton has an area of fifteen square miles. Of the other islands most are too small to be cultivated, while others afford a bare subsistence to a single family. The population is about 15,000, of whom fully two-thirds are black, chiefly descendants of slaves. Of the two principal towns St. George is the older, having sprung up around the army post at the north-easterly extremity of the group, but Hamilton, the capital, centrally situated and with an enclosed harbour easily entered by vessels drawing not more than sixteen feet of water, has become far more important.

The surface of the larger islands is far from monotonous, though their general altitude is not great. On the north shore the hills seldom exceed 100 feet in height; but in the south three or four exceed 200 feet. The highest, Scaurs or Town Hill, is 260 feet, according to Prof. Heilprin. Much of the land, however, is less than forty feet above the sea, and a subsidence to that extent would convert the present land area into a scattered archipelago with an area of five or six square miles.

The climate is much more temperate than would be expected in the latitude and in the belt of prevailing south-westerly winds. Frost rarely occurs, and in summer the thermometer seldom rises above 82° F. While the vegetation is as a whole subtropical, a few forms belonging to the Temperate zone are observed. The Bermuda cedar grows luxuriantly, and fruits and vegetables thrive, but grasses do not succeed and pasturage is scanty.

The rock deposits are the Red Clay, the Dune Sands, the Sandstone, the Limestone, and an intermediate deposit between the last two. The superficial covering consists largely of the red clay, which, in most places thin, attains a depth of fifteen or twenty feet in the "sinks" or depressions. By itself it is barren, but when mixed with disintegrated "sandstone" and vegetable matter it becomes remarkably productive, and the insignificant patches within the sinks are let at a high rental. It apparently is a residue from coral sand.

The upper rock of the islands, locally known as "sandstone," is as a rule fine-grained and of a creamy colour, and is almost pure carbonate of lime. Though very soft, it is the building stone in general use. Absorbing water rapidly, it is generally covered with whitewash which is soon converted into cementing material by the rain, though occasionally it is left bare, for it hardens externally when exposed to the air. Sometimes it is found wholly unconsolidated and as loose as dune sand, and is no doubt of Æolian origin, being the dune accumulation of former times. Next come certain intermediate deposits between the sandstone and limestone. Near St. George there is a conglomerate of angular limestone, red matter, and broken shells; in the softer portions numbers of *Helix* are found, as also in the overlying sandstone. Of greater interest is a marine limestone at Devonshire Bay which, being very compact on all sides and containing many perfect shells, must have been deposited very gradually in water. The limestone is the lowest rock now above water-level, and is commonly spoken of as the "base rock." It is hard and durable as a rule, though in a few rare cases as incoherent as the sandstone. It is laminated and shows a wind-drift structure, and no doubt, like the sandstone, is of Æolian origin.

Rainfall is abundant on the Bermudas, but, owing to the porosity of the rocks, the water filtrates quickly down to the sea, causing considerable subterranean erosion ; and to the collapse of roofs of caverns thus excavated must be ascribed the formation of many of the lagoons and harbours. The great reef or ledge flats extends from the southern extremity of the islands round to the north-east corner, and is continuous with the so-called bounding reef on the south-eastern side. In width it varies from one to two and a half miles, and for the most part is covered with water to a depth of from three to twenty-five feet. The flats are merely planed off islets on which corals have established themselves, and the process of formation may be observed in all its stages. Were the land to subside fifteen feet more, the shore would be moved inland nearly a quarter of a mile, and another line of islands would be formed, which in course of time would be planed off, making another strip of reef.

Having clearly and fully described the physical features of the islands, Professor Stevenson examines the views of Professors Rice, Heilprin, and Agassiz. It would be impossible to give a satisfactory abstract of this part of his article, and therefore it is better merely to report the author's own conclusions. The successive stages in the formation of the islands he describes as follows :—Firstly, the limestone was formed by the accumulation of dune sand, which, during a prolonged period of quiet, suffered severe erosion, superficial and subterranean. During a subsequent period the islands gradually sank 120 feet or more, and marine deposits encroached on the land, forming beach rock at widely separated localities and in somewhat anomalous positions. Then the sandstone was formed during a period of quiet, and the sinks were filled up. Fourthly, came a period of elevation, during which the land rose at least as high as its former level. The old subterranean drainage systems were re-established, and perhaps others formed, giving rise to new groups of depressions. Lastly, there was a period of subsidence, when the land sank very nearly to its level in the former period, the highest marine beds being now only a few feet from the water's edge. The more important sheets of water began to appear in the deeper depressions early in the period, but attained their present forms, due to shore erosion, only in the later part, when subsidence was very slow and interrupted more than once by prolonged periods of rest.

The Peak of Orizaba.—An ascent of this mountain has been recently made by Herr K. Th. Stöpel. In March last he rode from the town of Chalchicomula, a distance of thirteen miles, to the Cueva de los Muertos, on the south-western slope of the peak, at a height of 13,190 feet above sea-level. Rising at three o'clock in the morning, Herr Stöpel reached at five o'clock the upper limit of forest at an altitude of 15,000 feet. At 15,400 feet all vegetation ceases, and the ground is composed of lava, sand, and rock, without a trace of snow or ice. The last part of the ascent up to the crater edge was very difficult, three hours being required to clamber on hands and feet up the twenty feet of fissured rock that forms the lower pinnacle. The Santa Cruz point, 490 feet higher, was then climbed in twenty minutes. The readings of three aneroids gave the height as 18,333 feet, or only nineteen feet more than Dr. Scoville's trigonometric measurement (see vol. ix. p. 542). Herr Stöpel estimated the length of the crater at 1540 feet, its breadth at 1300, and its depth at 330.—*Aus Allen Welttheilen*, Heft 15.

Volcanoes in Central America.—Mr. A. Gosling, Consul-Gentral in Central America, writing to the Secretary of State for Foreign Affairs, says that in the early days o 1896 the volcano of Izalco in Salvador, which had been in a state of activity for more than a hundred years, suddenly became quiescent. Nowhere,

perhaps, except in Java, are volcanoes so numerous and of such varied formation as in Guatemala. The most notable are Agua and Fuego, 12,360 and 13,976 feet in height, respectively. Last century the former overwhelmed by its eruption the old Spanish city of Ciudad Vieja; and Guatemala la Antigua, the old capital, was totally destroyed by earthquakes due to the sudden activity of Fuego. In recent years seismic disturbances have been very rare. Izalco is a volcano of recent origin. Towards the end of last century its site was occupied by a fertile knoll, on which the Indians cultivated corn. The crops were frequently destroyed by fires, which, supposed to be the work of incendiaries, led to many bloody quarrels, and it was not till a gradual upheaval of the soil was observed that the true origin of these fires was recognised. In 1873 Izalco nearly destroyed the capital, San Salvador, and now has attained a height of five thousand feet, and is a well-known beacon for navigators.—*Quarterly Journ. of the Geol. Soc.*, May.

Southern Chile.—In December 1896 Dr. P. Krüger started from Puerto Montt to explore the Reñihue valley. On January 1st the expedition crossed the central cordillera at a height of three thousand feet, and reached some extensive longitudinal valleys lying between the central mass of the Andes and the continental watershed. Here are situated thirteen large lakes, which were examined, their affluents noted, and their hydrographical connections determined. The Staleufu was followed from its source to the valley of 16th October. It flows through a series of lakes entirely within the cordillera and in Chilian territory, and cut off from the Patagonian plateau by a range four thousand to five thousand feet high, which even in summer is not entirely free of snow. On February 5th, near the mountain Situacion, the expedition had to turn back, and therefore the question whether the Staleufu is the Rio Frio (see p. 62) seems to be as yet unsolved. The watershed is formed in the northern part of the region traversed by the Maitén, and in the south by the Leleque. The interval of about twelve miles is occupied by a large plain covered with pampas grass, which the watershed crosses by a line of gentle undulations.—*Globus*, Bd. lxxi., No. 20.

Fernando Noronha is an island in the South Atlantic, rather more than three degrees south of the Equator, and nearly four degrees north-east of Cape San Roque. Its length is about six miles and a half, and average breadth two miles. At a distance the outline of the island suggests a church, the spire being represented by a rugged barren pinnacle, eight hundred or nine hundred feet above sea-level. The heat of the equatorial zone is considerably modified in Fernando Noronha by the south-east trade wind. The shore is indented with numerous inlets, and runs out into green promontories. Thick groves cover much of the surface, and afford pleasant walks in the dry season, but during the rains the ground is too swampy. Once a resort of pirates, Fernando Noronha is now a convict settlement, containing about 1500 criminals from Brazil. After serving his time each convict receives a grant of land, which he is generally too lazy to cultivate.—*The South American Journal*, May 8th.

MISCELLANEOUS.

The **Belgian South Polar** expedition is to leave Europe at the end of July, under the command of Lieut. de Gerlache.

The **Acting Editor** having received leave of absence, his duties will be performed for the next three months by Mr. A. J. Herbertson, F.R.S.E.

The **Mombasa railway** is progressing rapidly. Thirty miles of it are completed, and the embankment has been made for a dozen miles farther. Three thousand Hindus and a few hundred Swahelis are employed on it.

Mr. Stuart Vines, the geologist of the FitzGerald expedition, has, with the guide Zurbriggen, ascended **Tupungato**. During the ascent they suffered severely from cold. The mountain, about 21,000 feet high, proved to be a volcano. Towards the west an active volcano was descried.

The **Geographical Society of Madrid** has formed a commercial section, which is to issue a *Revista de Geografia Colonial y Mercantil* in eight months of the year. The numbers that have already appeared contain articles and notes on the state of trade and on means of transport in various parts of the world—chiefly in Spanish possessions.

On May 8th an expedition under Lieut. Drizhenko left St. Petersburg for **Lake Baikal**. The lake will be sounded, its coasts surveyed, and natural history collections will be made. The work will be of especial importance to the navigation of the lake, and will be continued for five years. Listvennichnaia and Mysova, where the Siberian railway reaches the shore, will be the first points examined.

The **Creveaux colony**, founded to commemorate the French traveller who was murdered there by the Tobas, was destroyed early this year by an inundation of the Pilcomayo. The colony consisted only of a few wretched huts inhabited by about thirty soldiers and one hundred and fifty Indians. The site was unsuitable, the vegetation scanty, and the water insufficient for irrigation.—*Aus Allen Weltteilen*, Heft. 15.

Mr. John Cook has sent us his *Meteorology in Mysore for* 1895. The close agreement between the atmospheric pressure in Mysore and at Madras, mentioned in vol xii. p. 364, is again pointed out, and is confirmed by a table of the means for the years 1893-95. The mean annual temperatures in Mysore show a marked uniformity. The rainfall seems to have been rather heavier than usual, 33·45 inches being recorded on one hundred and thirteen rainy days, though a prolonged drought prevailed during the earlier months of 1895.

In a review of M. Martel's *Irlande et Cavernes Anglaises*, p. 333, is the sentence: 'It is a little humbling that a foreigner should lead the way in the exploration of **Gaping Ghyll**.' A correspondent writes to say that this cave, as well as Allum Pot, were explored by the late Mr. Birkbeck of Settle, some fifty years ago, and by Professor Boyd Dawkins about 1860. Mr. Birkbeck had some thrilling adventures to recount, while Professor Dawkins related his experiences in *Cave-Hunting*. It is true, however, that neither of these gentlemen examined the caves as thoroughly as M. Martel.

Two energetic supporters of exploration have recently passed away—**Baron Oscar Dickson**, and **Sir Thomas Elder, G.C.M.G.**. The former, a Swedish subject, but of Scotch extraction, was a life member of our Society. He was well known for the liberal support he gave to Arctic expeditions, especially to that of Baron Nordenskiöld along the north coast of Asia. A few years ago he made a most generous offer to the Australian colonies of funds to equip an Antarctic expedition, but owing to the financial difficulties then at their height, the colonial governments were unable to make up the necessary amount. Baron Dickson died at his estate on Lake Wetter on June 5th, in his seventy-fourth year.

Sir Thomas Elder, who died in March, was born in Fifeshire in 1818, and emigrated to Australia in 1854. He paid much attention to the introduction of new breeds of cattle, sheep, and horses into Australia. To his support and influence were due many of the expeditions into the interior of the continent, and through him camels were successfully used on several occasions. The Elder Scientific Exploring Expedition, under the command of Mr. D. Lindsay, was fitted out in 1891. It did not follow the route proposed, but collected some valuable material.

On Tuesday, June 8th, a monument to the late **Joseph Thomson** was unveiled by Sir Clements R. Markham, President of the Royal Geographical Society, at Thornhill, in the presence of a large assembly, consisting of the family of the deceased explorer and a number of members of the London and Scottish Geographical Societies and other friends. Mr. J. G. Bartholomew, Hon. Sec. of our Society, was unfortunately unable to be present, but the Society was worthily represented by Sheriff W. C. Smith. Mr. Thomas M'Kie, of Moat House, another member of the Society, took the chair, and, after a few introductory words, called upon Sir Clements Markham to unveil the memorial. In doing so, Sir C. Markham delivered a brief address, in which he paid a warm tribute to the moral and intellectual qualities of the late Joseph Thomson, the remarkable ability with which he conducted his expeditions, the consideration and care he bestowed on the men under his command, and his patience and forbearance in dealing with the natives. He also referred briefly to the achievements of Joseph Thomson in various parts of Africa.

Dr. Scott Keltie then handed over the memorial to the Dumfries County Council, by whom the site has been granted, and Mr. James Fingland, in the unavoidable absence of Mr. J. H. Dickson, chairman of the Thornhill District Committee, accepted the charge. Other speeches were made by Sir James Crichton-Browne, the Rev. Wallace Williamson, and Captain Harold Crichton-Browne, who had enjoyed the personal friendship of Joseph Thomson, and could therefore thoroughly appreciate his high character; and Mr. William Thomson and the Rev. J. B. Thomson responded—the former for his parents, and the latter to a vote of thanks for his biography of his brother.

The memorial consists of a truncated obelisk pedestal, made of freestone from the Gatelawbridge quarries, surmounted by a bust in bronze. The four sides are panelled. The front panel is occupied by a bas-relief in bronze, representing Fame, as a female figure, displaying a map of Africa, with palm-trees and Kilimanjaro in the background. The panel on the south side bears the inscription :—"Erected to Joseph Thomson, African Explorer, Fellow and Gold Medallist of the Royal Geographical Society, by Members of the R.G.S. and other friends." On the opposite panel is the inscription—"Expeditions. To Lakes Nyasa and Tanganyika, 1878-1880. Up the River Rovuma, 1881. Through Masailand and Kavirondo, 1883-1884. By the River Niger to Sokoto, 1885. To Morocco and the Atlas, 1888. Through British Central Africa, 1890-1891." The pedestal is decorated with masks, representing the heads of lions, which are placed at the bottom of each panel. It is nine feet high, and the bust is two feet. An iron railing, fixed in a low freestone wall, surrounds the monument.

The bust, which is much admired, is the work of the well-known sculptor, Mr. Charles M'Bride. A marble replica will be placed in the rooms of the Royal Geographical Society, and a plaster cast has been secured for the library of the Royal Scottish Geographical Society.

NEW BOOKS.

Itinerary of Prince Charles Edward Stuart from his Landing in Scotland, July 1745, to his Departure in September 1746. Compiled from *The Lyon in Mourning*, supplemented and corrected from other contemporary sources, by Walter Biggar Blaikie. Edinburgh: For the Scottish History Society, T. and A. Constable, 1897. Pp. xv + 136 and Map.

Mr. Blaikie has made a valuable contribution to the study of, perhaps, the most romantic episode in Scottish history, and especially to the geographical problems connected with the Prince's routes. The book is extremely modest in form, but it presents the condensed result of such exhaustive and conscientious inquiry as would have furnished forth a much more pretentious volume. Apart from the new light obtained from Colonel Allardyce's *Historical Papers of the Jacobite Period* and Lord Macleod's narrative in Sir William Fraser's *Earls of Cromarty*, Mr. Blaikie has examined a number of family manuscripts, and has received information from those belonging to the Duke of Athole, the descendant of that brilliant soldier and devoted patriot, Lord George Murray, and the Murray of Broughton Papers, now being edited by Mr. Fitzroy Bell: he prints in its entirety a deeply interesting memorial addressed by Macdonell of Lochgarry to Glengarry; and he gives an account of the military maps by Colonel Grant and John Finlayson, and of the Roman map. He has also been at infinite pains by correspondence with lairds, clergymen, town-clerks, and antiquarians, in both Scotland and England, to clearly identify the various houses, or caves, or bits of heather where the Prince lay on each night of his unfortunate undertaking; and he makes special acknowledgment of the help given by Colonel Macdonald of Glenaladale, the representative of another prominent figure in the rebellion.

The substance of the text re-appears on the 10-inch to the mile map which accompanies the book, and on which the routes are laid down in coloured lines. Mr. Blaikie writes in a clear, matter-of-fact style, but for Scottish readers his subject needs no writing up. To take a few examples of identification in 1745, we have on September 16th the Prince at Gray's Mill, Slateford (at the time when, according to tradition, the Highlanders visited Swanston): on November 1st, at the farm-house of Reddings, occupied by David Murray (this was just after crossing the Esk to "fell English ground"): on December 17th, in the Inn at Shap (where it is said he complained of overcharges, for Westmoreland was not like the "ever-dear Lancashire" of the beautiful song, "Farewell, Manchester, Noble Town, Farewell"). On the march to England part of the army went from Jedburgh by Mosspaul, but the Prince went from the same point by the top of Liddel, in fact by what is now the Newcastleton road. The Highland part of the route is of still greater interest. The evidence as to the site of "Cluny's Cage" in Ben Alder and the famous thicket of hollies is fairly stated, and the difficulties of the road into the Chisholm country are admitted. We are glad to find that Mr. Blaikie spares us the old house at Inverlaidnan, though not as the place of refuge from Culloden, for the Prince rode hard to Fort Augustus after the battle. Two photographs of the cave in Glenmoriston are printed. On the whole, the story of the Prince's wanderings remains one of the most marvellous records of fatigue and hardship endured in the roughest country in Scotland, and of narrow escape from a vigilant enemy, and of heroic loyalty among the Highlanders of Inverness-shire.

Mr. Blaikie deserves the hearty thanks of all lovers of Scottish history. The only phrase to which we can take exception occurs in the statement (p. 38) that a portion of the army was to go by Clova and Glen Muick to Speyside. This is a

little abrupt and misleading, and would rather suggest the line of Tomintoul; but as is correctly shown on the map, this division went from Ballater into Strathbogie, and crossed by Keith to the Spey at Gordon Castle.

The Ancient Volcanoes of Great Britain. By Sir Arch. Geikie, F.R.S., D.C.L., LL.D., etc. 2 vols. London: Macmillan and Co., 1897. Pp. xxiv + 477 and xv + 492. *Price* 36*s. net.*

In these handsome volumes Sir Archibald Geikie summarises his work amid the volcanic rocks of Great Britain and parts of Ireland—a work which has extended over a period of forty years, and has included a personal examination of all the important volcanic areas in these islands. Few, if any, British geologists have enjoyed such unrivalled opportunities of field-work as the author, and none, it may safely be said after perusing these pages, has made a better use of such golden opportunities. The greater part of the book has already been published in articles in various scientific journals, and in the publications of the Geological Survey, so that its contents are not, for the most part, new to geologists. No previous author has, however, undertaken the heavy task of drawing up a comprehensive history of volcanic action in this part of Europe, which, while complete in scope, is also sufficiently popular to be readable by others than professional geologists. Like other books from the author's pen, this work is both very readable and interesting, and no small part of its interest is due to the large selection of beautiful illustrations from Sir Archibald's sketch-book, and photographs of striking rock sections and landscapes in different volcanic districts. These districts are topographically indicated in a series of maps devoted to the volcanic rocks of the Cambrian, Silurian, Old Red Sandstone, Permian and Tertiary Ages respectively. The first volume begins with an account of the general principles and methods of investigation peculiar to this branch of geology.

The products and structure of modern volcanoes are compared with the relics of those of earlier ages, now only to be found in scattered fragments imbedded in ancient strata, in order to show how geologists arrive at the conclusions enlarged on in subsequent chapters. The rest of the first volume deals with the Palæozoic volcanic phenomena, and concludes with the Carboniferous volcanoes of the Forth basin. And here it may be noted that the author appears to have made a slip or two in some of his sections. For example, in fig. 114, section I. p. 384, the Campsie volcanic beds are shown as resting directly on the Lower Old Red Sandstone, whereas, in reality, these two formations are separated by a thin series of sedimentary strata of Lower Carboniferous age, shown on the Geological Survey maps of the district. The second volume is chiefly devoted to the volcanic history of the Tertiary age, whose principal manifestations are to be studied in the basalt plateaux of Antrim, and in the islands of Skye, Mull, Rum, Eigg, and parts of the western coast of Scotland. Much geographical interest attaches to the book, as it deals with the influence of the volcanic rocks on the physical features and scenery of the country generally. It is a work that will, like the author's great "Text Book," form a manual and reference volume in this department of geological science, and its appearance must be hailed as a worthy Jubilee contribution to the scientific literature of the Victorian era.

A History of Moray and Nairn. By Charles Rampini, L.L.D., Sheriff-Substitute of these Counties. Edinburgh and London: Blackwood and Sons, 1897. Pp. xiv + 438. *Price* 7*s.* 6*d. net.*

The third of Messrs. Blackwood's series of "Scottish County Histories" exhibits no falling off from the high standard reached in the Histories of Fife and of

Dumfries and Galloway. Sheriff Rampini has a most interesting theme, to which he has done ample justice. From the opening of the historical period in Scotland the province of Moray has been prominent in all the more important movements in the kingdom; and the histories, legends, and family traditions have been carefully collected by the learned Sheriff, and are narrated with the ease and skill of the practised raconteur. Perhaps it is a trifle hypercritical to say that in some cases he has followed the popular version rather than the sober and carefully reasoned conclusions of the latest historical science; as, for example, in giving the story of Macbeth from the pages of Hollinshed, or rather, perhaps, from Shakespeare.

The first chapter, dealing with the prehistoric annals of the province, shows a certain unfamiliarity with the recent researches into Celtic antiquities, which have thrown a flood of new light on prehistoric Scotland; to speak of the stone circles of Clava and elsewhere as merely gigantic sun-dials is to ignore all the modern learning relative to Druidism and the religion of the ancient Celts: to speak of Burghead, on p. 29, as a Norse Broch is surely begging the whole vexed question of its origin, and we cannot help thinking that the learned Sheriff has been led away by the local designation, "the Broch," and has ignored the fact that there are several other places in Scotland also called "the Broch," which certainly were not Norse Brochs. And surely the learned Sheriff is a little hasty in concluding that "the history of the Norsemen in Scotland has yet to be written." Doubtless there is much of that story which is still dark and enigmatical, but in face of the labours of Worsaae and Joseph Anderson the above statement is too sweeping.

The work contains much of interest from a geographical point of view. The reproduction of Timothy Pont's map, showing the country as it was some 250 years ago, raises curious questions from the very noticeable alteration of the coast-line. The sands of Culbin were not then formed, and what is now a bold sweep of a bay between Findhorn and Burghead, appears as an irregular line whose main direction was straight from point to point, with small indentations and a small inlet, running from the west of Burghead almost to Roseisle, perhaps the remains of that arm of the sea traditionally reported to have made it really an island. The Sheriff notices the fact that a submerged forest actually exists now below the waters of Burghead bay, whereof blackened stems are occasionally brought to the surface; but he does not mention the co-ordinate fact that lands far inland in the Laigh of Moray contain quantities of sea-shells buried far too deep to be accounted for by any application of fish manure or the like, and these two facts certainly point to extraordinary variations of coast-line within comparatively modern times, such as might well engage the attention of competent geographers. In such an investigation, the study of old maps like Timothy Pont's (even allowing for a certain inaccuracy of surveying), and such local place-names as Roseisle, with its island tradition, Earnside, now many miles from the Earn, or Findhorn, etc., would certainly be of the greatest value.

There can be no doubt that Sheriff Rampini has produced a most excellent and readable County History, opening to the general reader stores of information not easily accessible elsewhere.

The British Empire in the Nineteenth Century. By Edgar Sanderson, M.A. Vols. I. and II. London: Blackie and Son, 1897. Pp. viii + 336 and viii + 343.

This work, timeously undertaken, is to be a history of the progress of the Empire in the nineteenth century. The first two volumes, which are now before us, are for the most part introductory, and though giving a fair idea of the scope of the book, hardly afford a sufficient basis for a sound judgment on the execution of

the task which the author sets himself. The introduction is in three sections, each carrying its subject to the close of the eighteenth century. The first gives an account of the growth of our Constitution from the Great Charter onwards, of our foreign relations and wars, and of our religious, social, industrial, and commercial progress. The second sketches the origin and development of our colonial possessions in Europe (Gibraltar), Africa, America, the West Indies, and Australia. The third gives the history of the rise and progress of our Indian Empire. These are necessarily only brief outlines, but they are very interesting and are good historical summaries. The chapters on our experiences in America, in what are now the United States and Canada, are specially instructive.

About the middle of the second volume, the writer commences his work in earnest. From an introductory note we learn that he intends "to record in Parliamentary discussions and military undertakings only those measures and results that have become of permanent value to the nation, and dwelling more on peaceful progress in the civilised arts, on physical, moral, and intellectual improvement, than on victories won in warfare waged against human foes." In what he has done he certainly gives us good assurance that not only will this aim be kept well in view, but that it will be very successfully realised.

The volumes are handsome, well bound and well printed, and the book promises to be a valuable permanent possession to all interested in the wonderful progress of the nineteenth century.

Canada. By J. G. Bourinot, C.M.G., LL.D., D.C.L., etc. ("Story of the Nations" Series.) London: T. Fisher Unwin, 1897. *Price 5s.*

In a compendium of some 450 pages, the learned Clerk of the Canadian House of Commons has placed before his readers a graphic and interesting account of the history of the great British Colony on the other side of the Atlantic. He prefaces his history with a brief but comprehensive sketch of the principal physical features of the Dominion, giving suitable notice to its natural products, and after this there follows an interesting *résumé* of Canadian history, anterior to historic times properly so called. These begin early in the sixteenth century, when Jacques Cartier of Brittany was commissioned by the French King, Francis I., to sail west and, if possible, find a new route to India and Cathay. The indifferent success of Cartier did not discourage other adventurers from following in his footsteps, and Spaniards, Englishmen, and Scotchmen soon disputed with the French the possession of the new discovery. A graphic account is given of how each nation fared in its endeavours to gain the advantage over its rivals, and how the almost incessant wars in Europe affected the fortunes of the Canadian adventurers.

To this succeeds a necessarily succinct, but fairly complete, account of what is known of the distribution, habits, religion, and polity of the aboriginal Indians, more especially of the ferocious Iroquois, who were destined to play so important and terrible a part in the final struggle for ascendancy. The story of the courageous self-devotion of the Jesuits and Recollet Franciscan missionaries receives fitting notice and admiration—a story unrivalled in the annals of any Christian mission.

The failure of the French administration, which lasted, roughly speaking, from the middle of the seventeenth to the middle of the eighteenth century, is justly ascribed to the strange endeavour to make the ecclesiastical officers of state of greater importance and dignity than the civil and military, and to the rigid centralisation of authority which excluded the people from any share in even the pettiest matters of administration. The stirring story of the final struggle for Canada,

decided by Wolfe's brilliant victory on the plains of Abraham, is told with a vigour and swing which make us regret that the writer has not described it in greater detail.

The political history of Canada under British rule may be described as a series of attempts to blend into a harmonious whole two civilised and warlike peoples, differing in race and religion—a problem difficult enough at any time, but rendered unusually so in the case of Canada by the facts that the conquered race was a large majority, that consideration had to be paid to various tribes of uncivilised Indians, that the territory of the Dominion increased by leaps and bounds, and that the interests of numerous immigrants had to be remembered. How the problem was dealt with by various statesmen and parties is the theme of a considerable part of Dr. Bourinot's work, and it is very obvious he has done his best to be strictly impartial and fair to all sides. The Canada of to-day is briefly described in the last chapters. We must add that there is a good index and many interesting illustrations from sources "not accessible to the majority" of readers.

A Historical Geography of the British Colonies. By C. P. Lucas, B.A. Vol. iv. Parts i. and ii. *South and East Africa.* Oxford: Clarendon Press, 1897. Pp. 349 and 155. Seven and four maps. *Price* 6*s.* 6*d.* *and* 3*s.* 6*d.*

We have previously (*S.G.M.* iii. 607, v. 109, vii. 282, x. 272) had occasion to commend the admirable combination of fulness and accuracy of information, mastery of detail, sound geographical method, and good literary style, which we find in Mr. Lucas' work. These features are not less in evidence in this, the most recent of the volumes, the issue of which is most opportune, as it deals with a portion of our Empire to which much anxious attention is being paid.

In Part i. of this volume the history of British South Africa is "traced onward from the time when the Cape was merely a landmark, distant and dangerous, through the long years when it became a trading station on a peninsula, with small and scattered outposts of settlement on the mainland. The incoming of the English [*sic*] has been noticed, the dispersion of the Dutchmen, the difficulties between the white and black races, between the two sections of European settlers, between the white men in South Africa and their rulers at home. We have seen the historic tie which bound South Africa to the East gradually weakened and finally sundered, and have noted the rise of a South African dominion, becoming more and more continental, growing in stature and fulness. What will be its limits, how soon and in what manner its loose, long limbs will become fully set, is at present matter of speculation."

The earlier part of this history is perhaps not of very immediate interest; but the chapter entitled "The last twenty years in South Africa" tells graphically the story of the rapid, almost startling, development of the region during that time, and should be read carefully by all who desire to grasp the present conditions of the difficult South African problem. The carefully balanced estimate of the work and value of the Chartered Company is worth quoting:—"Those men as a rule do most and best work who have a pecuniary interest in the undertaking, and an actual or prospective share in the profits. . . . To criticise a company's acts and administration, to analyse, possibly to condemn, the motives of the promoters, is easy and to some is congenial. It is obvious that a private association is more adventurous and less safe than the state. It is obvious that there are serious drawbacks to the system of Chartered Companies, however carefully safeguarded, and that such defects are more apparent in modern days than in times when public opinion was less scrupulous, and criticism less outspoken. But, for the purpose of

studying the history of colonisation, Chartered Companies should be looked on as pioneers, and the question to be asked is not so much whether this or that company had this or that object in its formation or in its working, whether it is or is not likely to be financially successful, whether or not some of its dealings deserve reprobation, but rather, Is it a good thing that British colonisation should extend, and has the Chartered Company system promoted the extension? Englishmen [*sic*] are always being asked to apologise for themselves and for what they have done. The answer is that the English have been human, have made many mistakes, have done things which they ought not to have done, and still more have left undone things which they ought to have done; but, notwithstanding, their work has been in the main great, wholesome, and sound; and those who read a true record of what British colonisation has meant, and how it has been carried out, will realise that the world owes much to the system of Chartered Companies." And we may also note Mr. Lucas' wise reading of the important lesson to be learned from the story he tells, a lesson that we may hope has at last been grasped by our Imperial authorities:—"One lesson above all South Africa seems to teach—that the colonial policy of Great Britain should be consistent and unswerving, that constantly to go forward and back again is bad for all. It is the same throughout life, public and private. No men or people can lead, unless they are as good as their word. No men or people can lead, unless those around them, men, women, and children, and dumb animals too, are confident that as they have acted to-day, so under similar conditions they will act to-morrow. This one great lesson is sadly taught by South African history. If it were to be learnt thoroughly, for that one reason, beyond all others, we should have cause to value South Africa."

Part II., though said to be "Geographical," contains much historical matter relating to British Central Africa and British East Africa. It gives also a full and thorough account of the geography of all British South, Central, and East Africa.

Having spoken thus favourably of this work, we may be allowed to point out some weaknesses; for Mr. Lucas, being human and English, is not impeccable. Throughout the book there is a regrettable confusion between "Britain," "Great Britain," and "England," and between "British" and "English"; and this confusion is the more objectionable as in some places a distinction needs to be made, and then the previous confusion of terms nearly deprives them of their distinctive value. The confusion is well exemplified in the extracts above given. The mapping of the book is by no means on a level with the rest of its workmanship. The maps given are all small-scale maps showing merely political features, and they are not very good specimens of their class. Their scales are not related—each map being so drawn as to fill the space, or half the space, of a page. In the map to illustrate "Zulu and Boer wars 1879-81," a railway is shown reaching to the border town of Charlestown. "Ladysmith" in Natal is on the maps "Ladismith." Nowhere is there a map giving any idea of the orographical relief of the country, surely one of the basal facts in the history and possibilities of its development; nor are any of the facts of the physical geography of the country shown by maps. The general usefulness and accessibility of the work would be much increased by an analytical conspectus or table of contents; for the story of South Africa is long and somewhat involved, and it is not difficult to lose one's way in the reading of it, as our rulers have not seldom done in the making of it.

The defects we have here noted may easily be remedied, and so increased value be given to the future editions which the general excellence of the work should soon make necessary.

Spaziergänge in Süd-Italien. Von Ludwig Salomon. Oldenburg and Leipzig: A. Schwartz, 1897. Pp. 201. *Price* 3 *Marks.*

The countrymen of Goethe still show all his enthusiasm for Italy, and flock there in thousands every year. In this prettily illustrated book Herr Salomon brings together his South Italian rambles, extending from Rome to Palermo. His chapter on "New Rome" is perhaps as interesting as any, for it narrates the extraordinary change in the aspect of the Eternal City which has taken place since it was transformed from the capital of the Popes to the capital of Italy. We are so familiar with its present royal appearance that its former papal aspect, as described by Herr Salomon, is worth recalling:—"On entering Rome, a striking spectacle met the eye. Everywhere walked, dressed in motley garb, monks, nuns, and spiritual dignitaries, encompassed by a swarm of beggars, bagpipe-players, street-singers, and dancers. Here and there crouched in corners, surrounded by eager listeners, story-tellers and dream-interpreters. The thoroughfares were often entirely blocked, for every one gaped or knelt as a procession passed or the Holy Father drove from the Vatican to the Quirinal. The Pope drove only through streets on which yellow sand had previously been laid down. An outrider in brilliant uniform, the Battistrada, announced his Holiness's approach; then followed a squadron of dragoons, and after it came the glittering red Papal coach, drawn by enormous horses in gilded harness, with scarlet-liveried footmen hanging on in front and rear. A second squadron of dragoons closed the procession. During the passage of the Pope all balconies were adorned with gay cloths, and all the many little altars and saints' pictures in the houses were decked with lights and flowers. Everything looked festive and bright." There was, however, a dark side to the picture, for Papal Rome was very dirty and very unhealthy, and there was much point in Alfred Meissner's advice when Rome at last became the capital of Italy: "Rome is awake! and the first thing a sensible man has to do on awaking is to wash himself." The mortality of Rome, once enormous, is now between 16 and 20 per 1000.

Du Cap au Lac Nyassa. Par Édouard Foà. Paris: E. Plon, Nourrit et Cie., 1897. Pp. 382.

M. Foà's volume aims at giving in popular style a narrative of his travels in South and South-Central Africa, during the years 1891-94. This aim the writer successfully realises, though the earlier part of the book, in which his journeys in Cape Colony, the Orange Free State, the Transvaal, and Natal are recorded, is devoid of anything more than a personal interest. The latter part of the work describes the physical and mental characteristics, manners and customs, and geographical distribution of the tribes among whom M. Foà sojourned in his travels through Gazaland, Mashonaland, and Manicaland, and in the country lying between the Zambesi and Lake Nyassa. In this part the author contributes not a little to our knowledge of a territory that is gradually being opened up, and his information is both interesting and valuable. On political questions M. Foà touches but lightly: this is well, for the time that has elapsed since he completed his travels has sufficed to change these in more ways than one. It should be added that the book is well illustrated by reproductions of photographs; several inaccuracies in the spelling of names of places, which the use of a railway timetable would have prevented, and the absence of a map, are to be regretted in a book which is thoroughly enjoyable and useful, and which will commend itself, by the popularity of its subject, and the ease of its style, to a wide circle of readers.

Dahomé—Niger—Touareg : Notes et Récits de Voyage. Par le Commandant Toutée. Paris : Librairie Armand Colin et Cie., 1897. Pp. xxi + 370 *Prix F.* 4.

Intrusted with a political mission to the Niger regions, Commandant Toutée left Marseilles on 20th November 1894, and in due course disembarked at the French port of Cotonou, on the Bight of Benin. The causes which sometimes necessitate such missions are amusingly explained by the author, and if his account be accurate it throws a queer light on the methods occasionally followed by European nations in their partition of Africa :—

"L'homme blanc prend généralement la peine avant son départ de recevoir, en même temps que les subsides de son gouvernement, l'autorisation de traiter en son nom. Disons tout de suite que s'il a négligé la deuxième partie de cette formalité (car il néglige bien rarement la première), les actes d'exploration diplomatique qu'il rapportera ne seront pas moins reçus avec faveur et revêtus de l'autorité de son souverain. Lorsque ce souverain a délégué ses droits à une compagnie à charte, ces maisons de commerce organisent généralement l'industrie de l'explorateur comme une machine à traiter à petits frais et à grand rendement. L'agence remet à son envoyé des liasses de traités tout imprimés, il n'aura qu'à signer pour son compte, et si la haute partie contractante adverse ne sait pas signer, à signer pour elle. Comme, en pays nègre, ce dernier cas se présente neuf fois sur dix, la signature d'un traité ne donne lieu à aucune lenteur, à aucune hésitation, et pratiquement, au retour, le voyageur rapporte des traités conclus avec tous les chefs des villages où il s'est arrêté. Il a poussé le plus souvent la condescendance ou l'effort jusqu'à entrer en conversation avec ces malheureux, et même à leur demander leur nom. Mais s'il a omis ce dernier détail, c'est un vice de forme qu'on serait mal venu de critiquer."

The party commanded by Toutée travelled north through French Dahomey, and then in an easterly direction, till it struck the Niger at Arenberg, whence the river was ascended to Say and Zindé. In this upper region the travellers appear to have been much impressed by the fact that the Tuaregs, who constitute the ruling caste, are of very light complexion—indeed, "white men." And very troublesome people they found them to be.

Instead of regaining the coast through French territory, Captain Toutée found it convenient to descend the Niger to Lokoja, at which place, and afterwards at Lagos, he was hospitably entertained by our officers. From Lagos he made his way to Cotonou, and thence sailed for Marseilles.

Letters from the Sudan. By the Special Correspondent of the *Times* (E. F. Knight). Reprinted from the *Times* of April to October 1896. With Illustrations and Plans. London : Macmillan and Co., 1897. Pp. 325. *Price* 8*s.* 6*d. net.*

Those who followed the advance on Dongola, and read in the *Times* the graphic letters which Mr. Knight contributed from time to time, will be glad to have them in a collected form. The story of the successful campaign against the Dervishes is graphically portrayed, and the illustrations and plans add considerably to the value of the volume. To those interested in the Sudan we can commend the book.

Rambles in Central China. By W. Arthur Cornaby. London : Charles H. Kelly, 1896. Pp. 96.

This is a slight sketch of some of the towns and villages in the neighbourhood of Hankow, and the work of the missionaries in that region. It contains some interesting information, and is written in a very simple style, evidently meant for the benefit of juvenile readers. A list of lantern sides is given at the end of the book, which are to be used as illustrations to the text.

The Pamirs and the Source of the Oxus. By the Right Hon. George N. Curzon, M.P., Gold Medallist of the Royal Geographical Society. London: The Royal Geographical Society. Pp. 83. *Price 6s. net.*

This small book is a reprint of the article which appeared in *The Geographical Journal* of 1896. Mr. Curzon describes the Pamirs as a whole, and discusses in particular the claims of the headwaters of the Oxus to be considered the main river, deciding in favour of the Panja or Ab-i-Panj, rising near the Wakh-jir pass at a height of 14,700 feet. The book is well illustrated, and accompanied by an excellent map of the Pamirs.

Von Java's Feuerbergen. Das Tengger-Gebirge und der Vulkan Bromo. Von Dr. med. Franz Kronecker. Oldenburg und Leipzig: Schulzesche Hofbuchhandlung, 1897. Pp. 30. *Price M. 2.*

The largest of the maps accompanying Dr. Kronecker's brochure shows very clearly the route taken by him in his wanderings among the volcanic mountains of Eastern Java; and there are besides two small maps, of which one represents the ground-plan of the crater of Mount Bromo as it appeared in 1844, while the other is the reproduction of a sketch of the same crater, made in 1895 by Captain Schulze, who accompanied the author. Of the ten illustrations, only four relate to the special subject of the work: with regard to which, however, there is much precise information in the text. The average reader, as well as the specialist, will find Dr. Kronecker's pamphlet to be interesting reading.

Grundriss der Ethnologischen Jurisprudenz. Von Dr. Albert Hermann Post. Erster Band. Allgemeiner Teil. Pp. 473. Zweiter Band. Spezieller Teil. Pp. 735 and Index. Oldenburg and Leipzig: A Schwartz, 1894-95. *Price 16 M.*

Dr. Post is anxious that some day an Encyclopædia of Universal Law should be constructed, and that the laws of isolated nations or primitive peoples should not be confined to monographs dealing with isolated districts.

In order to pave the way for such an undertaking, he has written this book, which he hopes may serve as a basis upon which others may build, and from which may grow "a brilliant palace of human knowledge." In the first volume he deals with ethnology and law, the origin of law, the elementary forms of social organisation, which are divided into various classes, and then in the second he goes on to deal with law as it affects the person, the family, inheritance, and marriage, and also criminal law in various parts of the world. The sketch which he has given of law as it occurs in different regions of the globe is of extreme interest, and the way he has grouped the various laws relating to the same subject in different countries shows what an intimate knowledge he has of his subject, and what a comprehensive grasp of primitive legal procedure.

The book will be of value not only to ethnologists but also to lawyers, and it is so clearly written that even the general reader cannot fail to be interested in it.

Sul Regime Idraulico dei Laghi. Del Ing. Gandenzio Fantoli. Milano: Ulrico Hoepli, 1897. Pp. xiv + 349. *Prezzo L. 8.*

In this treatise, which gained a prize from the Reale Istituto Lombardo di Scienze e Lettere, the author deals very fully with the rise of the surface of lakes and their discharge in relation to the rainfall over their basin, storage of water in the ground and the melting of the snow, his data being for the most part drawn from observations in the basin of Lake Maggiore, which is subject

to great changes of level, though many records are also cited for comparison from the Swiss and other Italian lakes. Having considered the data yielded by observation, Signor Fantoli expresses the results in formulæ from which the variations in the level, outflow, etc., can be deduced, and finally he discusses the effects of artificial regulation of the discharge. The work has been compiled with great care and ability, and is particularly to be recommended to the attention of hydraulic engineers.

Catalogue des Bibliographies Géologiques. Rédigé, avec le concours des membres de la Commission Bibliographique du Congrès. Par Emm. de Margerie. Paris: Gauthier-Villars et Fils, 1896. Pp. xxx + 733.

This thick volume, compiled at the instance of the Geological Congress, is not, as the compiler is careful to point out, simply a bibliography of geology, but a bibliography of bibliographies of geology. It contains no fewer than 3918 entries, divided into a general section and a geographical section, in the latter of which the books are entered under the continent or country of which they treat. Indexes are also added of authors' names and principal subjects, and a note on each book gives information on the nature of its contents. Geologists cannot be too grateful to M. de Margerie and his collaborateurs for thus aiding them in their search after geological publications.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. London: Charles Griffin and Co., 1897. *Price 7s. 6d.*

Having reached its fourteenth year, this annual has become well established, and has proved its usefulness. A few societies have sent no returns to the editor, or their address is not known. It is to be hoped that the secretaries of these societies will assist in making the *Year-Book* complete.

London of To-day. An Illustrated Handbook for the Season, 1897. By Charles Eyre Pascoe. London: Bemrose and Sons. Pp. 250. *Price 1s.*

A very neat and handy edition has been issued for the Diamond Jubilee year. A special chapter treats of the Jubilee Day, and of some of the improvements in the metropolis since the beginning of the reign. Some of the pleasure resorts outside London are described, and numerous illustrations add to the attractions of this guide.

The Argus Annual and South African Gazetteer, 1897. Johannesburg, Cape Town, Pretoria, and London: The *Argus* Printing and Publishing Company. Pp. 529. *Price 6s., post free.*

There is no difference in the general arrangement of the *Annual* since it was last noticed, in vol. xi. p. 214. It contains the smaller alterations and additions necessary to bring it up to date. Thus the boundaries recently laid down in Rhodesia are given in full, and projected railway extensions, etc., are noticed, besides many other details due to the rapid progress of the country. We take this opportunity of rectifying an error in our last notice, where the absence of a list of professors in the Cape Town University was commented on; the University is simply an examining institution.

Stockholm. Guides of the Swedish Tourists' Club. No. 14. Stockholm: Wahlström and Widstrand. Pp. 87.

A useful guide to the town and environs, illustrated with numerous good photographs. The museums, parks, public buildings, etc., are fully described. There are also chapters on excursions on Lake Mälar and in the Baltic Archipelago. The guide is well got up, and should induce tourists to visit the clean, bright town and its charming surroundings.

Illustrated Europe. No. 170.—*The Baths of Bex.* By V. Tissot and Sam. Cornut. Nos. 171 and 172.—*Meiringen and its Environs.* By Otto Jossi. Zürich: Art. Inst. Orell Füssli, n.d.

Both these pamphlets deal with places much resorted to by British tourists. We have frequently noticed this series, and therefore need not say much on these numbers. They contain all that is required by the ordinary tourist, besides a few notes on the history, geology, botany, etc., of the places described.

Northern Germany as far as the Bavarian and Austrian Frontiers. By Karl Baedeker. Leipsic: Karl Baedeker, 1897. Pp. xxxiv + 442. *Price M.* 8.

We have to announce the issue of the twelfth English edition of this guide-book. It has grown considerably since the time when the *Rhine* used to be incorporated with it, and of late the maps and plans have been much improved. Excellent maps of small districts are a noticeable feature.

British South Africa: A History of the Colony of the Cape of Good Hope from its Conquest 1795 to the Settlement of Albany by the British Emigration of 1819. By Colin Turing Campbell. London: John Haddon and Co., 1897. Pp. viii + 222.

This work contains a general sketch of the earlier history of Cape Colony, and a very detailed account of the British Settlement at Albany, with biographical notices of the more distinguished settlers. The story of this settlement is of great interest, and there is no doubt that the author is largely in the right in saying that "it is to the period of the British Settlement of 1820 in the history of the Colony that its progress and development as a part of the British Empire is to be traced." The author has obviously spared no pains in the collection of his material, and tells his story in a manner that shows his keen interest in it. But a more careful revisal of MS. or proof might have prevented occasional useless repetition of minor facts; and it is quite surprising that any author or proof-reader can have passed so very many glaringly faulty pieces of English as are found in the book.

Geographisches Namenbuch. Erklärung Geographischer Namen nebst Aussprache-bezeichnung. Von Edmund Oppermann. Hannover: Carl Mayer, 1896. Pp. 167. *Price M.* 2; *boards M.* 2·25.

A useful and interesting little book explanatory of geographical names. The names are not arranged alphabetically, but geographically, according to countries; and a short note, etymological, descriptive, or historical, is added, and, when necessary, the pronunciation indicated. The phonetical transcription of foreign sounds, though rather rough and ready, is sufficient for practical purposes and generally accurate. But we notice Dun'dee, with the emphasis on the first syllable. The explanations, based on Egli and other good authorities, seem on the whole to be trustworthy. An English book written on similar lines might be welcome in this country.

Short Spins round Edinburgh. By Harry R. G. Inglis. Edinburgh: Gall and Inglis, 1897. Pp. xi + 142. *Price 6d.*

This little book is a local supplement to the *Contour Road Book of Scotland*, which was noticed in vol. xii. p. 495, where the new and excellent plan followed in both works was sufficiently explained. In the present small volume small crossroads are included, which necessarily had to be omitted in a work dealing with the whole of Scotland, and the descriptions are somewhat fuller.

Boletin del Instituto Geológico de México. Num. 3.—*La Geografía Física y la Geología de la Peninsula de Yucatan.* Por el Dr. Carlos Sapper. Nums. 4, 5, y 6.—*Bosquejo Geológico de México.* Mexico: Oficina Tip. de la Secretaria de Fomento, 1896 and 1897. Pp. 57 and 270.

Dr. Carl Sapper has often contributed papers to German geographical publications, and his name must be familiar to readers of the magazine. In the above publication he treats of the geology, climatology, products, etc., of Chiapas and Yucatan, a part of Central America where there is still much work to be done by the scientific explorer. In fact, the latter is very little known owing to the absence of roads and, we believe, the hostility of the Indians in some of the western parts. In character it differs greatly from Chiapas, where alluvium and volcanic ash form extensive plains, whereas nearly the whole of the Yucatan peninsula is undulating, and is composed of sedimentary rocks, with a very slight dip or horizontal. Besides the geology and geography of the country, Dr. Sapper gives some information on the forests and limits of vegetation, on sport, grazing, and agriculture, and his work is furnished with numerous maps. It is a welcome addition to the scanty scientific literature of the southern provinces of Mexico.

The other volume contains the itineraries of the geologists—R. J. Buelna, E. Ordóñez, and J. G. Aguilera—a general sketch of the geology of the country, and a chapter on the eruptive rocks, so largely distributed over the surface. The granites, gneiss, and schists, the sedimentary rocks and the eruptive rocks, which occupy nearly equal portions of the surface of the country, are described in detail, with lists of fossils found in particular series; and the work is illustrated by a geological map and numerous sections.

Die Liparischen Inseln. 7^te^ Heft—*Stromboli.* Prague: Heinrich Mercy, 1896. Pp. 51 folio.

The princely series of eight volumes on the Lipari Islands, which have been reviewed at intervals, closes with this, the seventh, volume (the eighth having preceded it), being a monograph on Stromboli, an island renowned for its volcano, and the most interesting of the Lipari group. The little towns of San Vicienzu and Piscità nestle at the base of the volcano, and the igneous soil of the island is devoted to the culture of the vine. With the aid of the magnificent illustrations of Friedrich Hawránek, we become familiar with Stromboli, its inhabitants, their dwellings, and the cactus and other vegetation which springs from amid its volcanic rocks, whilst a carefully contoured map furnishes us with a bird's-eye view of the island. These illustrations also bring out the extraordinary weathering undergone by the lava masses, which occasionally rise like fantastically carved pinnacles from the land surface. The author describes the eruptions of Stromboli as most impressive during south-east or south-west winds. "Then," he says, "a veritable sea of fire enwraps the flanks of the mountain, and it is interesting in the highest degree to watch the apparently incandescent stones, generally in three great streams, hurling themselves over the precipice, and in wild bounds, and creating all sorts of fiery forms, leaping into the sea."

NEW MAPS.

EUROPE.

DEVONSHIRE. By J. Bartholomew, F.R.G.S. Scale, 4 miles to an inch. *Price* 2*s.*, *cloth.* *W. H. Smith and Son, London.*

ATLASES.

THE MULTUM IN PARVO ATLAS OF THE WORLD. Fourth edition. *Price* 2*s.* 6*d.* *W. and A. K. Johnston, Edinburgh and London,* 1897.

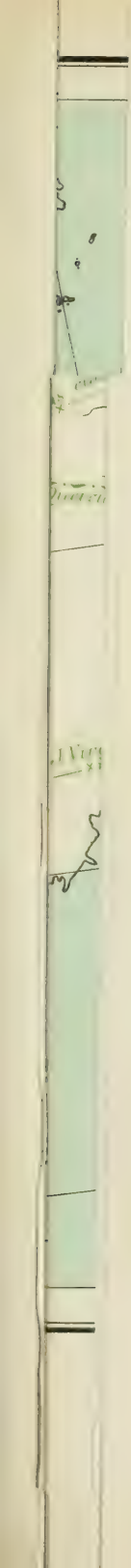
No doubt atlases of this size are useful to the general reader, as the position of any large town or prominent natural feature may be looked up without the trouble of consulting a large unwieldy volume. The above atlas justifies its name, for it contains ninety-six maps, an index, and a large amount of statistical information. Some of the physical maps are too small to exhibit more than the most general outlines—the Geological Map of the British Isles, for instance. On the other hand, some of the special maps, as those of Cyprus, Iceland, and the Suez Canal, will serve for all ordinary purposes. The atlas is an excellent one of its kind.

OUR EMPIRE ATLAS. With Introduction by C. P. Lucas, B.A. *W. and A. K. Johnston, Edinburgh and London.*

Of this collection of fifty-nine plates, those which are entirely new and naturally attract attention at the present time are the half-dozen which show the expansion of the Empire during the last sixty years, one being devoted to the additions in each decade, and the first showing the Empire at the beginning of this period. It seems hardly correct to assign, as is done in the last mentioned, the islands north of North America to the Empire, seeing that many of them were still unknown; nor have we any claim to the north-west coast of Greenland, especially to those parts discovered by Greely and Peary. The other maps are up to date, and the introduction, necessarily brief, is written by the well-known author of the *Historical Geography of the British Colonies.*

SCHULATLAS FÜR HÖHERE LEHRANSTALTEN. Bearbeitet und herausgegeben von C. Diercke und E. Gaebler. 33^{e} durchgesehene und vermehrte Auflage. 157 Haupt- und 152 Neben-Karten. Revision von 1897, pp. 152. *Price* 6 *Marks.* *Georg Westermann, Braunschweig,* 1897.

A good atlas in its thirty-third edition is a German phenomenon, as is an atlas with over 300 maps, costing 6*s.* It may interest many to know that only fourteen maps out of the 309 are the ordinary political ones that crowd our atlases; that the majority are maps showing physical features, and that 100 maps illustrate the distribution of temperature, rainfall, vegetation, animals, population, races, religions, and other matters too often neglected in our school atlases. These climatic and economic maps are not only given for the world, but for each of the continents, and, in the case of Europe, for each of the great divisions of the continent. This is as it should be. The maps, however, have not been brought up to date in every case, and while the execution compares favourably with that in the majority of school atlases produced in this country, we have seen better maps printed in Germany. The teacher, however, will find in the atlas a cheap mine of material which he can easily reproduce on the blackboard to the great advantage of his class.



MAP
SHOWING THE
LIMITS OF VARIOUS TREES
IN
CANADA
BY DR ROBERT BELL
From the latest data up to 1882
SOUTHAMPTON ISLAND
HUDSON STRAIT
JAMES BAY
Richmond Gulf
LAKE SUPERIOR
LAKE HURON
LAKE ONTARIO
LAKE ERIE
GULF OF ST LAWRENCE
NEW BRUNSWICK
NOVA SCOTIA
NEWFOUNDLAND
ATLANTIC OCEAN

THE SCOTTISH
GEOGRAPHICAL
MAGAZINE.

NOTES ON TIERRA DEL FUEGO.

An Account of the Swedish Expedition of 1895-97.

By Dr. Otto Nordenskjöld.

In the year 1895, thanks mainly to the liberality of the late Baron Oscar Dickson and of some other private gentlemen, an expedition consisting of Mr. Dusén, botanist, Dr. Ohlin, zoologist, and of myself, geologist and leader of the party, was able to leave Sweden for South America. Our general object was to study the physical geography and natural history of Tierra del Fuego and of the southernmost part of the continent, and our special purpose to compare the natural features of those regions with the corresponding ones of Northern Europe, and to bring home collections of sub-Antarctic forms, the subsequent study of which might stimulate the interest in Antarctic exploration.[1] The members of the party arrived at Punta Arenas (Sandy Point), a small town on the north shore of the Straits of Magellan, and the principal political and commercial centre of those regions, at the beginning of the Antarctic summer of 1895-96. For that summer we worked chiefly in the Fuegian archipelago south of the Straits, where, mainly owing to the kindness of the Chilean and Argentine Governments in affording us the means of transport, we were able to visit the country far more extensively, both along the coast and up into the interior, than any previous scientific expedition had done. At the end of June 1896 we all left the region, but in the following summer I went back alone and explored Southern Patagonia especially, and in Tierra del Fuego the environs of Useless Bay, which had not been visited the previous year.

[1] A notice of the zoological work accomplished by our expedition appeared in *Natural Science* for September 1896.

In the following notes I intend to give a preliminary account of the physical geography, particularly of the large main island of the archipelago, pending a fuller report to appear in the special volume intended to comprehend all the scientific results of the expedition.

The island mentioned, Tierra del Fuego in a narrower sense, has an area of nearly 20,000 square miles (two-thirds that of Scotland), and consists topographically of two distinct zones, viz., a woodless tableland in the north, and a mountainous territory in the south, the latter being the extreme continuation of the South American cordilleras. Each of these zones consists of two elevated regions, divided by deep valleys, but, as described below, of very different characters. The boundary between the two zones is an almost straight line, that crosses the Western channels in lat. 53° 40′ S. and reaches the Atlantic in lat. 54° 30′ S. South of this line flat country is to be found practically only in the river valleys, that rarely reach a width of more than one or two miles. The rest of the land-surface is occupied by a mountain chain, formed mainly of folded schists. Massive rocks are very subsidiary, but where they are found they generally stand out conspicuously in the topography, as, for instance, Mount Sarmiento, the most striking and probably the highest summit in the archipelago. With such exceptions, however, the country has a peculiarly monotonous aspect, resembling, one might say, a high wall, with a few not very prominent rounded summits, and here and there a narrow cleft. It is only in the attempt to cross the mountain chain that the traveller finds how wrong such an impression in reality is. He climbs the mountains, first their lower parts, covered with luxuriant vegetation, then the more elevated slopes, from about 2500 feet upwards, bare or covered only with enormous masses of loose stones and with patches of eternal snow, until he reaches the highest parts and expects to find, as in most other countries, a comparatively level plain, where he can walk on for miles without either descending or ascending. But I have never come upon such plains in those regions. The usual thing is rather to find oneself on a narrow ridge, steeply descending into a deep, narrow valley of almost level surface, through which a deep river, whose waters are white with suspended glacier mud, slowly trickles in complicated windings. On the other side of the valley another steep wall ascends, covered lower down with forest. In a distance of ten miles it may often be necessary to go down and up in this way some 3000 feet three times or more; and, considering the difficulty of traversing the forests, whether it may be through the full-grown ones in the valleys, or the dense shrubs on the upper slopes, it is very evident that travelling in the Fuegian cordilleras is not an easy undertaking.

The enormous development of the river valleys is connected with the general tendency in the whole southern cordillera to form longitudinal valleys. Of such, the above-mentioned valley that divides the two chains forming the Fuegian cordillera from each other, is an excellent example. It is occupied partly by Admiralty Sound, a narrow bay about fifty miles in length, partly by the Fagnano lake, discovered in 1892, that runs east and west, and has a length of upwards of sixty miles, and an area of

more than 200 square miles. The height of the lake above the sea-level is about 200 feet, and it is connected with the Admiralty Sound by a broad river, called Rio Azopardo, with many rapids in its course, but no falls. The total length of the valley on the island itself is consequently at least 120 miles; but it is to be noticed that this valley is the immediate continuation of the western fjord-like section of the Straits of Magellan. As to its origin: it is undoubtedly a longitudinal valley, following, perhaps, an anticlinal line, and I think it most probably is a sculpture-valley formed by the action of running water, its peculiar shape—both the Admiralty Sound and the lake are very deep with steep sides—being due partly to the action of glaciers. The cliffs on both sides of the valley are formed of the same kind of slate, but farther north, different—probably younger—slates enter into the composition of the northern chain, as in some parts folded tertiary rocks also do, showing that the formation of the cordilleras was not completed at that last-named period.

Difficult as it is to cross the mountains, to pass along their axis is not much easier. A ridge of considerable extent may, perhaps, be found in the central parts, but nearer the coast the surface is diversified by numerous transverse valleys, sometimes deep and narrow fjords, in this district usually not very large, and sometimes river valleys, like the one described above, with but a slight inclination, and evidently forming supramarine continuations of the fjords. To the geography and the origin of those valleys I have devoted much attention, and I think it is still more difficult here than with the longitudinal valleys to suppose that they can have got their actual shape without the aid of ice-action, though their first beginning is probably much older than the glacial epoch. Nowadays, in the regions I visited in Tierra del Fuego, there are no very extensive glaciers, compared with those of Norway or Southern Patagonia, though numerous small ones descend as far as the level of the Beagle channel.

I have spoken above of the rather monotonous aspect of the Fuegian channels, and the *general* appearance is certainly not so fine as, for instance, that of the Norwegian coast, in spite of the more luxuriant vegetation here, and the proximity of the glaciers to the sea. There is, however, no lack of beautiful scenery, and some parts, such as Ushuaia, with its view over the fine Darwin mountains, and the curious pointed peak of Olivaia (or Olivia), or the Chasm reach in the Patagonian waters, are hardly surpassed in any other fjord-coast.

Topographically, there exists in Tierra del Fuego no real zone of transition between the cordillera and the northern table-land. The appearance of the last-named region is utterly different from what we have just described. In the whole country there is not a single trace of solid rock to be seen.[1] The ground consists mainly of tertiary rocks—of which, however, the erosion has left only inconsiderable, though in

[1] In this there is a very remarkable point of difference from the state of things in the South Patagonia, where basaltic lava beds exist to a large extent. I succeeded, however, in finding one very small volcanic crater in Tierra del Fuego, north of Useless Bay, the first known, and perhaps the only one existing on this side of the Straits.

places very prominent remnants—hillocks with rounded slopes, but with summits either pointed or cut off by a flat surface. Such hillocks, however, are to be seen only in a few parts of the island. Yet little level country exists. Of such there is, first, the broad, noticeable valley that runs from St. Sebastian Bay to Useless Bay, two very large gulfs of the Patagonian type, flanked by high perpendicular "barrancas."[1] In the interior, the gulfs slowly pass over into a low, flat stretch of country, overgrown with grass and covered by extensive lagoons, mostly containing salt water. No part of it is higher than 150 to 200 feet, and the whole, at a not very distant date, has evidently been a strait of the same character as the eastern Straits of Magellan. But that such a strait has not existed very recently, or in the time of man, as some previous visitors of these regions have assumed, is shown by many signs. The land is not rising rapidly enough for this. A well-defined old shore line, at the height of about 200 feet from the present sea-level, with big stones on it, shows us that at the time when the sea covered the island to that height the climate was still cold enough for a far greater extension of glaciers than at present, and the sea was crowded with huge icebergs, that brought big masses of granitic rock with them from the western islands.

Further, we find level country in the highest parts of the region. Between the 53rd degree of latitude and Useless Bay, from the Straits to the Atlantic, there is a wide bit of high table-land, descending slowly towards the east from 1800 to 600 feet. This is a very barren tract of ground, the soil being composed of coarse gravel with rounded stones and overgrown with lichens, *Empetrum*, and the semi-spherical masses of a curious kind of *Azorella*. Herds of guanacos may be seen here sometimes in summer-time; but for the most part it is a realm of death, the terrible Patagonian south-west gales prevailing here in their full strength.

Land of the same character also occurs on the south side of the San Sebastian valley, but not to the same extent. The tertiary rocks are seen in greater abundance, but in most parts they are covered with low, rounded hills, chiefly consisting of morainic material. The land rises very gradually towards the cordillera, so that it is difficult for water from the interior to find an egress. The development of river valleys in this territory is consequently all the more remarkable. Between 53° and 54° 30′ S. lat. there are on the east side only two really big rivers—the Rio Grande (also known as the Rio Popper, after the prominent Fuegian explorer) and the Rio Carmen Silva. Both those rivers derive most of their water from the cordillera, their chief sources lying near Nose Peak, so that they traverse almost the whole breadth of the island. The former, by far the most important river in this part of the island, has its outlet in a narrow estuary, to which steamers drawing ten to twelve feet of water can approach in spite of the bar blocking the entrance. It receives several big tributaries, of which one, explored by the Boundary Commission, comes from a small mountain lake on the Chilean side, while another, hitherto unknown, and to which I gave the name "Rio Candelaria," was followed by us to its sources, which we discovered in some

[1] The Spanish name for walls in sedimentary rocks.

peat-mosses at the very foot of the cordilleras, not far from Lake Fagnano. The valley of this tributary is typical of all the river valleys in this region. Its width is nearly one mile, but often this is a level terrace on one side or another of the real river valley, which is very narrow. Through it the river winds in wonderfully tortuous bends, just as in the cordillera valleys, so that it is often impossible, when following the course of the river on horseback, to keep in the valley without repeatedly crossing the river or ascending the walls of the valley, which, being always high and steep, makes this also a difficult undertaking. The river receives many small tributaries, whose valleys are always of the same character as the above; the sides are of corresponding height and the fall is almost equally imperceptible. Still more curious, moreover, is the impression made by the valleys in the northern tableland, where these deep, narrow gorges remind one of the cañons of some other dry countries.

Before finishing this short review of the physical geography of Tierra del Fuego there is another feature we must consider: that is the hills of morainic material—a typical boulder-clay with angular stones, often with scratched surfaces, intercalated at times with beds of sedimentary origin. Those hills are often high and have very peculiar forms: conical, pyramidal, etc., with steep sides. They occur more particularly on both sides of the northern table-shaped ridge, and extend to the Atlantic; but they are never found higher up than 500 or 600 feet. Undoubtedly the island was once covered with ice at least to that height, and that this glacial epoch came to an end not very long ago is shown by the distribution of animals and plants, the narrow Straits of Magellan forming the southern limit for a number of species.

The climate of Tierra del Fuego is very different in different parts. The mean temperature certainly is more or less the same, about $+6^\circ$ C. (43° F.) in all parts; but in the north the climate has far more of a continental character than in the south. Yet in San Sebastian, in the north-east corner, the difference between the summer (December to February) and the winter (June to August) mean varies only from $+10^\circ$ to $+1{\cdot}2^\circ$ (50° to 34° F.). In the south-west, however, the variation is much smaller, and in some parts of the archipelago we may really assert that summer and winter do not exist. Still more striking, however, is the difference in the rainfall in different parts. Thus in Punta Arenas 370 mm. (15 in.) fall annually, while in the environs of San Sebastian the figure certainly does not reach 300 mm. (12 in.). At Ushuaia it is about 650 mm. (26 in.). These figures are all much below what has been generally supposed; but from the last-mentioned place onwards the amount increases very rapidly, reaching in the south-western archipelago, a distance of only 80 to 100 miles from Ushuaia, almost 2000 mm. (80 in.).

By reason of the different topographical and climatic conditions the vegetation in the north is far from being similar to that in the south of the island, and, indeed, the two have almost no resemblance to each other. The northern part is an open *pampa*, without any trees, and only in certain sheltered places low bushes of *Berberis* or *Ribes magellanica* can

grow. The Antarctic forest begins south of Useless Bay and the 54th parallel, but it consists at first of one single species, a low-growing variety of the Antarctic beech (*Fagus Pumilio*) in close, dense clumps, more extensive farther south, and growing only on the hills and valley slopes. A zone of taller forest-trees (*Fagus antarctica*) begins at the same place as the cordillera, while along the shores of the Beagle channel we first meet with some fresh species of tree, viz., the evergreen beech (*Fagus betuloides*) and the magnolia (*Drimys winteri*). The forest grows denser and more impenetrable the farther west we go on the main island; and likewise in the southern archipelago, where it has the appearance so marvellously described by Darwin, Cunningham, and others. In the most humid parts *Fagus antarctica* does not occur at the sea-level, but a new tree, the cypress (*Libocedrus*), is here met with.

Summing up all the facts and points of view given above, we can fairly divide Tierra del Fuego into the following four zones:—

1. *The Northern Pampa Territory*, consisting of tertiary rocks, covered partly by gravel, forming a vast table-land, partly by morainic material, deposited mostly in curious-shaped hills. The quantity of rain is less than 350 mm. (14 in.) annually; trees never grow, and the characteristic plants are the *Berberis*, *Chilotrichum*, and in the driest parts the thick-leaved *Lepidophyllum*. The lower parts are overgrown with rich grass, but at 500 feet and above the land is mostly very barren.

2. *The Central or Fagus Pumilio Zone* has an average height of from 150 to 500 feet. As the hills rise slowly with rounded contours it is difficult to find a point for a good view over the country, especially as they are generally covered with trees. But, taken as a whole, the country is for the most part open, or at least without any continuous covering of forest, and is overgrown with grass, replaced only in the most southerly parts by peat. Herds of guanacos are very common, and the general appearance of the country, with its fine glens and soft vegetation, is very pleasing. The rainfall amounts to from 350 to 500 mm. (14 to 20 in.).

3. *The Mountain or Fagus antarctica Zone*, with a rainfall of up to 800 mm. (32 ins.), is occupied by the central cordillera, the lower slopes of which are overgrown to a height of 1500 to 2000 feet with dense, uninterrupted forest of Antarctic beech. Of this there occasionally occur trunks with a diameter of six or seven feet. The mountain chain is cut up into numerous narrow ridges by river valleys, the bottom-surface of them covered with peat.

4. *The Outer or Fagus betuloides Zone*, with an annual average rainfall of more than 800 mm. (32 ins.), lies principally on the outer archipelago. The rocks, in great part eruptive, are more variable than in the central cordillera, the mountain summits lower and generally more rounded. The vegetation also is far more luxuriant, except on the bare rock, or in such places as are very much exposed to the wind, where only low, stunted bushes can exist.

The first three zones are inhabited by Indians of the Ona tribe, a tall, broad-shouldered, strong-limbed race, resembling the Patagonian Tehuelches, with whom they probably once formed a single tribe, but not very

recently, as the differences in their languages, which are now pretty considerable, show. The dwellers on the shores of the Beagle channel and of the southern archipelago, the Yaghans, are smaller, and their language, as well as their mode of life, is very different from those of the Onas.

Before concluding these notes it is worth while to add a remark or two on the new inhabitants of the island, the white settlers. Until quite recently they kept exclusively to the shore, but their mode of living is very different in the two principal zones of the territory. For many years the only white people living in the island were the missionaries sent out by the South American Missionary Society, who worked amongst the Yaghans in Ushuaia on the Beagle channel. Not until near the end of the Seventies, after the discovery of traces of gold, did settlers begin to frequent these regions. When the island was appropriated by Chile and the Argentine Republic in 1881, the former secured the coasts of the Straits, with the capital Punta Arenas, so it was necessary for the Argentines to found some centre for their trade in the territory. They chose Ushuaia for this purpose, where a small colony already existed, and from that time the southern shores, though far more inhospitable than the northern region, have as a matter of fact been more resorted to by people than the latter. Numbers of people still get a living by gold-digging, others again by killing seals, though that is now prohibited; but most of them also keep some sheep or cattle.

In contrast to the state of things in the south, almost all the land in the north is occupied by a few big companies, all founded for sheep-farming; but some gold digging is also carried on. The first farmers landed here in 1885, but down to the present day they have had great difficulties to encounter in their relations with the Indians; but as the land seems very well adapted for sheep-farming, and it is calculated that it can feed three millions of them, this industry ought to have a grand future. The biggest farm, at Useless Bay, now has about 100,000 sheep. It belongs to an Anglo-Chilean company. Most of the people, however, both in this region and in the whole territory bordering the Straits of Magellan, whether they be owners, managers, or shepherds, are English-speaking, many of them Scotsmen, who in many cases have come hither from the Falkland Islands.[1]

For the traveller who is not desirous of exploring the most inaccessible or quite unknown parts of the country, a visit to Tierra del Fuego does not offer any *very* great difficulties. Moreover, leaving aside the numerous scientific questions that still demand a solution, such as the glacial geology of the district and the language and the mode of life of the aboriginal inhabitants, whose number seems likely soon to become a vanishing quantity, there is plenty of beautiful scenery of an interesting character, perhaps more varied than in any other part of the world; and there is abundance, too, of wild life alone with nature, so that a visit to this district, that approaches the Antarctic circle nearer than any other, cannot fail to repay the traveller who undertakes it.

[1] All the most suitable land for farming purposes in Tierra del Fuego is already occupied, and the only part of the Magellanic territory where good, unappropriated ground, adapted for sheep-farming, can yet be had at reasonable prices seems to be in South Patagonia, in the valleys of the rivers Gallegos and Coile.

NOTES ON EXPLORATION WITHIN BRITISH TERRITORY DURING THE LAST SIXTY YEARS.

When the Lecky of the future comes to write the history of the United Kingdom during the nineteenth century some of the most interesting of his chapters will have to be devoted to the expansion of the Empire during the Victorian era. It would be quite impossible here, within the limits of an ordinary article, to anticipate such an exposition, and we are happy in the hope that the attempt to do so would be futile and premature, as the Victorian era is, we trust, by no means ended. A glance at the map of the Empire in 1897 as compared with the map of 1837 cannot fail to arouse interest and evoke legitimate pride in the hearts of all.

In Europe, indeed, the British Empire has territorially diminished, for we have given up the Ionian Islands to Greece and Heligoland to Germany. *Per contra*, we occupy Cyprus with the consent of the Sultan of Turkey. Proposals to retire from Gibraltar and Malta have not been heard of for years, and may now be considered as beyond the range of practical politics. In North America the dispute as to the possession of the territory of Oregon was settled in 1846, and the land divided between Britain and the United States. In the Arctic regions island after island has been brought under the Union Jack. No fresh acquisitions of territory, however, have been made to the Empire in South America.

But in Asia the accessions to our territory have been very remarkable. They include Perim, Aden, and the island of Socotra on the west of the continent, the islands of Labuan and Hongkong and a large territory in North Borneo on the east. On the south we have acquired what is known as the Straits Settlements. But by far the largest of our annexations have been in and around India, more especially the kingdom of Burma, which alone has an area of over 170,000 square miles. In Australasia our most important acquisitions have been the islands of New Zealand and the Fiji group, and a tract of some 90,000 square miles in the south-east of New Guinea.

Last and greatest of all comes Africa, where British enterprise has expanded the Empire in a way that reads more like the imaginings of a romance than the sober utterances of truth. In 1837 the British possessions consisted simply of Cape Colony on the south, and Sierra Leone and Bathurst on the west; in 1897 we have a vastly enlarged Cape Colony, with Basutoland, Bechuanaland, Natal, and Zululand on the south; Gambia, Sierra Leone, Gold Coast Colony, and Lagos on the west, besides the enormous territories administered by the Chartered Companies, viz., the Royal Niger Company, the British South Africa Company, and that lately relinquished by the Imperial British East Africa Company to the Government. The area annexed or brought under British influence in Africa alone is something like two million square miles—a vast territory of much the same extent as that of Russia in Europe. Its boundaries in places are undetermined, and this practically means that

our African empire will increase until it becomes coterminous with territory held by some other European power. In the following pages we propose to mention very briefly some of the most notable explorations which have been made within the empire during the Victorian era.

Asia.

During the Victorian era the principal accessions to the Indian Empire have been the Punjab, Oudh, and Burma. So far as the interior of the Empire is concerned, it has been thoroughly explored. We have had in India a trigonometrical survey, a topographical survey, a geological survey, an archæological survey, and a marine survey. The trigonometrical survey is practically coeval with the century, for it was commenced in 1802 by Major Lambton. The topographical surveys under Mackenzie and Colebrooke were contemporaneous with the trigonometrical. The geological survey falls within our period, as it was begun in 1856 under Oldham. The archæological survey was still later. It was begun in 1860 under General Cunningham. The marine survey was latest of all, as it was not established till 1874-75.

Before the commencement of the era under notice a very considerable part of the area of the Indian empire had been surveyed, more especially in Madras, under the guidance of Lambton and Mackenzie, and in Bengal under Sir George Everest and his successors. On the north-east frontier the outbreak of hostilities with Burma in 1825 had given the survey an excellent opportunity of commencing operations for a complete exploration of the Brahmaputra. These were followed by operations in Manipur, Cachar, and the tract between Maulmain and Ava, and Kiang Hung near the frontier of China. With the exploration of the last-mentioned tract by Richardson we reach the commencement of the Victorian era, during which the regular work of the trigonometrical and topographical surveys has been so sedulously and successfully carried on that any detailed notice of what has been accomplished would be impossible within our limits. In 1845 the North-eastern Himalayan survey, and in 1847 the North-western Himalayan survey were commenced, and by the end of 1853 they had completed the line from Purniah to Attock. The survey of Kashmir was begun in 1855 and finished by Montgomery in 1864; that of Pegu was begun in 1854 and finished in 1865 by Edgcombe.

No small part of our knowledge of geography beyond our Indian frontier has been due to the intrepidity and skill of native explorers, who, for the purpose of concealing their identity, and thereby promoting their own personal security, were content to work under the designation of a figure or a letter. Pandit Nain Singh, who is well known to geographers as Pandit A, and Krishn Singh, his cousin, who is equally well known as A—k, are very good examples of this class of explorer. The Pandit was directed in 1865 to penetrate into the interior of Tibet from the Manasarovar lake to Lhasa, and to ascertain what he could regarding the course of the Sanpo river. He executed his difficult task with brilliant success, and visited the Palti or Yamdok-cho lake on his

way to Lhasa, where he paid his respects to the boy Lama, and collected much interesting information about him, his court, and territory. He was rewarded with the decoration of C.I.E., which he had thoroughly deserved. His cousin, however, in 1878-82, achieved an exploit greater even than that of the Pandit, for "he traversed the entire breadth of the Tibetan plateau from its origin in the Himalayas to where its northernmost spurs die away in the Mongolian deserts, and explored a large tract of unknown ground on the confines of south-eastern Tibet and western China." He proved that the Sanpo does not flow into the Irawadi basin, but is indeed the Brahmaputra, and has its exit through the channel of the Dihong, and his assertion has been verified by another and less fortunate surveyor, K. P., who traced the Sanpo to within a distance of forty-three miles from the highest known point of the Dihong. A—k, or Krishn Singh, was rewarded with the honorary title of Rai Bahadar and a grant of land. In 1876 another native explorer, known as the "Mallah," explored the Indus and some of the lateral valleys, the Ghizar and Sar Laspur valleys and the Tui pass. In 1878 he surveyed the Swat valley, making his way as far as the Palesar pass.

The opportunity of adding to our knowledge of the geography of Afghanistan, which was afforded to us by the Afghan war of 1878, was utilised to the full, for a geographical party was attached to each of the three attacking columns. The work was continued after the tragedy of Cavagnari at Kabul. In all an area of about 46,000 square miles was efficiently surveyed.

About this time survey operations were being pushed on in Assam, Sikkim, and Burma.

The punitive expeditions known as the Wazaristan campaign and the Zhob valley expedition afforded welcome opportunities for the survey of Wazaristan and the Zhob valley in 1881. In 1883 the Takht i Sulaiman mountain and the adjoining territory were surveyed. The surveys of the Jowaki hills and Black mountain regions were completed when the punitive expeditions against their turbulent inhabitants were undertaken. Macnair's adventurous journey into Swat and Chitral in 1883 may also be mentioned, and that of Carey in 1885-86 from Leh through Tibet and Chinese Turkistan.

In 1884 a strong geographical party was attached to the Afghan Boundary Commission, and with it went Mr. Ney Elias, whose lamented death occurred only a short time ago. His explorations of the Pamirs and Upper Oxus are well known.

In 1884-85 the Himalaya survey party continued its work towards the Gandak river, Nepal, Bhutan, and Eastern Kumaun. In 1887-88 the triangulation of Western Nepal was extended to the Gandak, and a circuit was completed round Kanchanjanga. Much of Bhutan is still practically a *terra incognita* as compared with the adjoining countries; but, thanks to the Eden expedition in 1864, we know a good deal regarding the western part from the observations of Godwin-Austen.

Surveying was begun in the north-east of Assam in 1884, when the party ascended the Noa Dihing river, crossed the Chaukan pass, and

reached Langdao and Padao on the Mali-kha river. A tract between the Naga Hills and the Hukong valley, and another tract south of the Patkoi range were explored in 1888. Recently this range has again attracted the attention of the Indian authorities, who hope to find a suitable route over it for a railway connecting India and Burma.

The whole of Lower Burma has been surveyed topographically, and after the annexation of Upper Burma in 1886 the topographical survey was begun, but owing to the disturbed state of the country little progress was made for some years. The exploration of the Irawadi was begun by Wilcox before the Victorian era, and continued by Woodthorpe and Macgregor in 1884-85, by Fenton in 1890, and again by Grey in 1892. Grey ascended by the Phungurai-kha, or eastern branch, and got to within a few days' march of the Chinese frontier.

Last year Prince Henry of Orleans finally settled the question of the course of the Irawadi. Though it had been sufficiently demonstrated, by the researches already alluded to, that this river had no connection with the Sanpo, it was still within the bonds of possibility that it might be a continuation of some Tibetan river. Prince Henry, however, on the march from Ta-li-fu to Sadiya, discovered the sources of the Irawadi in lat. 28° on the southern slope of the Zayul Khanung range, which A—k reported as intervening between eastern Tibet and Burma.

The necessity, or at least the expediency, of an overland trade route from Burma to China has long been recognised by those in charge of British interests in the East. The first expedition with that object was that of Sladen in 1868. He sailed from Mandalay to Bhamo, and thence, after encountering many difficulties from his supposed Burmese friends, he made his way through the Shan country, and on to Momein, the frontier town on the western side of Yünnan. The routes from Bhamo to Momein were surveyed, and satisfactory relations with the Kabyars and Shans were established. A second expedition was despatched in 1874-75 with the same object, but it was a disastrous failure, in which Mr. Margary was murdered. In 1879-80 Soltau and Stevenson made their memorable journey from Bhamo to Shanghai, an account of which was given to this Society in 1888.

Since 1881 the distinguished travellers, Messrs. Hallett and Colquhoun, have been impressing not only the expediency but the possibility of a line of railway to connect India with China *via* the Shan States and Siam. Mr. Colquhoun travelled overland from Canton to the Irawadi and Bhamo, and has elaborately explained the geographical conditions of the intervening lands in his well-known work *Across Chryse*. He has been ably seconded by Mr. Hallett, whose views are set forth in his *A Thousand Miles on an Elephant*.[1] Lord Lamington's adventurous journey from Bangkok to Tongking through the Shan States is well known to our readers, as the explorer gave a graphic account of it at one of our meetings in 1891.

There remain, then, only the Malay Peninsula and Borneo to be dealt

[1] It will also be remembered that Mr. Hallett gave an interesting address on "The Exploration Survey for a railway connection between India, Siam, and China" to this Society in 1885.

with. For the former a very few words will suffice. At the beginning of the Victorian era the possessions of Great Britain were limited to Singapore, Malacca, and Penang, with the Wellesley province. Since then several states have been taken under British protection, but still comparatively little is known of the interior. Some little exploration had been done in the neighbourhood of the settlements; Lealdang, the Mount Ophir of the Portuguese, had been ascended by Colonel Farquhar. Within our period the chief explorers have been surveyors, mining engineers, and other officials. Conspicuous among these is Mr. D. D. Daly, who between 1875 and 1882 executed a rough survey of Selangor, ascended the Moar river and crossed the peninsula to the mouth of the Pahang river, and determined the boundaries between Perak and Kedah and Patani. Of late, Mr. L. Wray, state geologist, and Mr. G. A. Lefroy, chief surveyor, have been active in the neighbourhood of Perak.

The establishment of British colonies in Borneo dates back only from 1841. In 1838 Rajah Brooke sailed from England, and became ruler of Sarawak in 1841. Labuan became British in 1846, and our rights over British North Borneo were fully recognised only some twenty years ago. The earliest explorer of the period was R. Burns, who in 1848 ascended several of the rivers of Brunei and Sarawak. Four years later the celebrated Ida Pfeiffer crossed from Sarawak into the valley of the Kapuas, and O. Beccari followed in her steps fourteen years later. Spenser St. John, Consul-General in Borneo, has given the best account of the country, and he was the first to obtain valuable information on North Borneo or Sabah, besides being the first European to ascend, in 1858, the mountain Kinabalu. Early in the seventies, C. de Crespigny made several journeys up the rivers, and some ten years later Leys travelled on the Padas Lawas and Limbang. A second ascent of Kinabalu was made by Giordano and Bove in 1873. Perhaps the most important of the later travellers were W. F. Witti and Frank Hatton, who explored a considerable part of the north and north-eastern portion of North Borneo in 1880 and 1882. As a result of these investigations the general orography and hydrography of the country are fairly well known, but there is still much detailed work to be done in most parts, and a considerable tract in the southern part of North Borneo is almost a blank on our maps.

Africa.

In the fifteenth and sixteenth centuries the Portuguese had explored a considerable portion of the coast and had travelled over a good part of Abyssinia, and Payz, one of their explorers, had undoubtedly visited the source of the Blue Nile. In the latter half of the eighteenth century James Bruce also reached its source, visited the junction of the Blue and the White Nile, near the modern town of Khartum, and saw in the latter river the product of the rain-clouds near the equator. In the seventeenth and eighteenth centuries the British had attempted trading expeditions on the Gambia, but with very indifferent success. The French were equally unsuccessful on the Senegal, but they founded the town

of St. Louis. The African Association, in the latter half of the eighteenth century, instituted various expeditions up the Gambia with the object of reaching the Niger, the best known of which are the two expeditions of Mungo Park, the famous Scots explorer, in 1795 and 1805. His route lay for the most part in what is now known as the French Sudan. In his second expedition he again reached the Niger, and commenced the descent of the river, but unhappily lost his life at Bussa, in the Yauri territory. The expedition of Denham and Clapperton had explored a good deal of the territory adjoining and beyond Lake Chad, and Clapperton made another expedition from Badagry on the Bight of Benin northwards to the tracts near the lake, and died at Sokoto. At length, in 1831, the problem of the true course of the Niger was solved by the brothers Lander, who crossed from Badagry to Bussa, where Park had lost his life, and thence went down the river, discovered the Benue, and ultimately reached the sea. M'Gregor Laird had profited by the Landers' work to examine into the trading possibilities of the Niger before the Queen's accession.

With regard to the south of the continent, we may remark that even before Cape Colony passed into the hands of the British in 1806, there had been some explorations of the interior throwing considerable light on Great and Little Namaqualand, Kaffraria, and Bechuanaland and the eastern branch of the Orange river. After 1806 a missionary, Campbell, penetrated across the Orange river into Griqualand, and east to the present Bloomfontein, visited Griqualand, and marched westwards through the desert to Pella on the Orange river in Namaqualand. On another expedition he passed through Griqualand to Bechuanaland into what is now known as Khama's territory, his most northern point being Karichana, the capital of the Marotzes. Campbell, as an explorer, was succeeded by Moffat, the father-in-law of Livingstone. His first expedition was from Cape Town to Pella, on the Orange river, where he lived for some time, during which he explored the adjoining country and made an expedition to Griqualand. After this he made one expedition from Cape Town to the Kuruman river, Latakoo, and Bechuanaland, and another to Pitsani and Matabililand.

In brief, before the Queen succeeded to the throne, a good deal of South Africa, from Cape Town to Namaqualand and the Orange river, had fairly been explored, and something was known of the present Orange Free State, Bechuanaland, and Matabililand. In North Africa, the Nile to Abyssinia and the Niger were the only rivers whose courses had been almost completely traversed by Europeans. Elsewhere the maps of the period were almost blank in the interior, save for a few travellers' routes and conjectures.

The greater part of Africa has been explored during the Queen's long reign. The Royal Geographical Society, more than any other body, must be credited with the equipment of expedition after expedition, which returned with the tale of new discoveries in the great unknown continent.

In West Africa there was no expedition of importance until 1850, when Dr. Barth started from Tripoli across the desert to Lake Chad

and Bornu, and explored more fully the region round about it. Passing to the south-east of Lake Chad, he discovered the Shari river flowing into that lake, and then turning westwards explored the Adamawa country. Here he was the first European to see the upper course of the Benue, the principal tributary of the Niger, and to reach Yola, the capital of the Adamawa region.

Barth is perhaps best known for his journey to Timbuctu, where he spent some months. He returned to Lake Chad, and then crossed the desert to Tripoli after having spent five years in West Central Africa, and earned a name second to but few among African explorers.

Rohlfs in 1866 explored part of the course of the Benue, and then followed the Niger to Rabba, from which place he passed across country to Lagos.

The first expeditions to the interior from what is now British East Africa, were made from the Church mission station at Mombasa. In 1848 Rebmann first sighted the snowy summit of Kilimanjaro, and in 1849 Krapf discovered Mount Kenya. Some people at home, while unwilling to credit the existence of these mountains, were ready to investigate the truth of the report of a great lake in the interior, told to the missionaries by the natives. The Royal Geographical Society accordingly sent Captain Burton, who was joined by Lieutenant Speke, to explore this lake region. After visiting the missionaries at Mombasa, the explorers pushed westwards, and for three weeks were compelled by renewed illness to rest as guests of a sheik, who told them that the reported lake consisted really of three lakes. Burton insisted on going eastwards to Ujiji on Tanganyika, the middle lake. Only a small portion of the coast was examined, and the travellers returned to the former host's, where Burton was so ill that he had to be left. Speke went on alone northwards to Lake Ukerewe, which he first saw at the end of July 1858, and named the Victoria Nyanza.

Speke had concluded from the information received from the natives, that this great lake must be the source of the Nile. To test this theory he returned to Africa in 1860, accompanied by Captain Grant. The old route to the interior was followed by Unyamwezi, and they pushed on to the Victoria Nyanza. M'tesa invited them to Uganda, where they spent some months. The river seen to issue from the lake was followed closely enough to permit its being identified with the Nile, down which they proceeded, and met Mr. and Mrs. Baker journeying up-stream at their own expense to meet and help them. Mr. and Mrs. Baker decided to explore the bend of the river not followed by Speke and Grant. In March 1864 they looked down on the waters of a great lake which they named the Albert Nyanza. Might not this lake have some connection with Tanganyika as well as Victoria? Baker inclined to this idea, which was one held by Livingstone, whose great work we must now outline.

Dr. Livingstone was a missionary in the service of the London Missionary Society, in South Africa. Pushing northwards, he made his first discovery of importance in 1849, when he reached Lake Ngami, to the north-west of what is now Khama's country. In 1851 he advanced still farther into the interior until he reached the Chobe river, and

farther on the Zambesi, which he found at this point a great stream 360 yards wide, even in the dry season. Up to this time his wife and family had been with him, but he returned with them to Cape Town, and from there sent them home. In 1853 he turned northwards again, across the Kalahari desert to Linyanti, the capital of the Makololo, where he had been well received before. From Linyanti he started for the west coast, holding north through the Barotse country by the river Liambai, passing the beautiful Gonye Falls. Leaving the Liambai, he ascended the Liba into the Balonda territory, and there he changed his course to the west to avoid slave-traders, and discovered Lake Dilolo, the source of the Liba. At the summit of the highlands he looked into the valley of the Kwango, but turned away from the forests of the Congo basin, across the beautiful parkland to the west, and reached Loando, receiving much kindness from the Portuguese.

After a much-needed rest, he left the west coast for the east coast in September 1854, and passed over almost the same ground to the Zambesi, receiving a hearty welcome from the natives everywhere. After a short stay at Linyanti, he started for his journey down the great Zambesi. In a short time he heard and saw the magnificent falls which were named Victoria Falls. Keeping somewhat north of the left bank of the Zambesi, he struck the Kafue river, and followed it to its junction with the Zambesi. After that, his course to the east was practically that of the Zambesi. He spent some weeks making collections at Tete, and reached Quillimane in May 1856, after an absence from Cape Town of nearly four years, during which he had crossed Africa from west to east, from Loanda to Quillimane.

In 1858 Livingstone returned to the Zambesi, having been formally intrusted by Government with an expedition to explore it and the adjoining lands. He was accompanied by Dr., now Sir, John Kirk. From Tete he made three visits to the Kebrabasa rapids, which prevented his launch going further. In 1859 he made three attempts to follow the Shiré, on the second he discovered Lake Shirwa, and on the third he reached the great Lake Nyasa, of which he was in search. Returning to the Zambesi, he visited once more the Victoria Falls and Sesheke. The next years were devoted to the exploration of Lake Nyasa and the Shiré Highlands, where Scottish missionaries have done such noble work in recent years.

Livingstone's third and last expedition began in 1866 from a bay to the north of the Rovuma river, whence, literally cutting his way through the jungle, he pierced to Lake Nyasa, which he explored. In January 1867 he discovered the river Chambeze, from which he went northwards to Tanganyika. Hearing of a lake in the west he set out and reached Lake Mweru; and in July 1868 he discovered Lake Bangweolo. The exploration of the network of waters in this region was Livingstone's work during the next three years. He had really discovered the head-waters of the Congo, the Chambeze flowing into Lake Bangweolo, the Luapula leaving it and entering Lake Mweru, and, farther north, the union of this river with the Lualaba. But Livingstone did not know this. He believed that these rivers belonged to the Nile basin.

Pitifully broken down in health he returned to Ujiji, on Lake Tanganyika, to learn that it was supposed he had been murdered, and his agent had sold all his property and appropriated the proceeds. It was here he was met by Mr. Stanley in November 1871. Instead of returning home, as Mr. Stanley urged him to do, he remained at Unyanyembi waiting for supplies, declaring he could not go home till he had satisfied himself regarding the sources of the Nile. The supplies reached him in August 1872, and he started for Lakes Tanganyika and Bangweolo, near which the gallant and devoted explorer breathed his last on the 4th May 1873. Commander Cameron, charged with an expedition to take supplies to Livingstone, met his dead body being conveyed to the coast, and, after arranging for its transport to England, he proceeded westwards, surveyed Tanganyika, and ultimately crossed Africa to the west coast.

Dr. Livingstone's work in Africa differed from that of previous explorers, and is still marked by characteristics uncommon in that of many of his successors. He did not merely make rapid journeys across unknown regions, but revealed the geography of a vast territory by his careful work. Wherever he journeyed he carried his medical skill and his missionary labours. At the same time, he was ever anxious to open out the new lands to trade. If we can look proudly to-day on the work accomplished in British Central Africa it is because of the pioneer work of Livingstone, and that of his successors, both in the mission-field and in Government administration, who have laboured with the same spirit of practical, scientific, and moral enthusiasm. The reports and works of Sir Harry Johnston, H.M. Commissioner, gives admirable accounts of this good work, in which his own share is not a small one.

Mr. Stanley in his first expedition simply crossed from Bagamoyo, on the coast, through Ugogo and Unyanyembi territories to Ujiji, where he found Livingstone, with whom he stayed some months, and then returned to Bagamoyo. His second expedition began in November 1874, when he crossed over to Lake Victoria Nyanza, whose shores he surveyed. By this voyage he proved that the lake had only one outlet, that at the Ripon Falls. A visit to the well-known M'tesa of Uganda impressed Mr. Stanley profoundly, and the result of his letters home was the sending out of the Uganda Mission. To the west of Uganda he discovered a great sheet of water, which he thought a part of Lake Albert, and named the Beatrice Gulf. Proceeding to Ujiji, on Tanganyika, he circumnavigated the lake, and pushed on westwards to Nyangwe, where he made the acquaintance of the notorious slave-dealer Tipu Tib. In November 1876 he started down the great Congo, bordered by virgin forest, and fought his way to the coast; thus solving the last great river-problem of Africa.

The third expedition to Africa, led by Mr. Stanley, is known as the Emin Pasha Relief Expedition. He sailed up the Congo, and proceeded eastwards, encountering many difficulties, both from the natives and in the nature of the country traversed. In April 1889 Stanley and Emin left the Lake Albert district, proceeded up the Semliki river, and discovered the snow-capped Ruwenzori mountain, the sheet of water which he formerly

called Beatrice Gulf, now recognised to be a great lake and named the Albert Edward Nyanza, and proved that it was joined to the Albert Nyanza by the Semliki river. The route to the coast was over more or less familiar ground. After his rescue, Emin Pasha returned to the Equatorial Lakes as head of a German expedition, and with Dr. Stuhlmann explored the region round Lakes Albert Edward and Albert.

Before this, discoveries of importance in British East Africa had been made by another Scotsman, Joseph Thomson. His successful leadership of the Royal Geographical Society's Central African Lakes Expedition, after Keith Johnston's sad death, had been universally admired. He was accordingly intrusted with the difficult mission of exploring the land of the turbulent pastoral Masai. After climbing Kilimanjaro to 9000 feet he had to return to the coast, but soon set out again, reaching Mount Kenya at the end of 1883, and, after exploring Lake Baringo, he went on the Victoria Nyanza, and on the return journey visited Mount Elgon with its cave-dwellers, carrying out his difficult task without recourse to violence.

In 1887-88 Count Teleki and Lieutenant von Höhnel explored the land north of Lake Baringo, and carefully mapped the great Lake Rudolf and the smaller Lake Stefanie, in the great drift valley which has been visited and described by several other explorers.

In recent years the knowledge of African lands has grown rapidly, owing to the action of several European powers in taking large regions under their protection, and sending out expeditions to secure or confirm their claims to them. Several purely scientific expeditions have also been carried out.

In East Africa Dr. Peters marched from the mouth of the Tana to the sources of the Nile in the interests of the Germans;[1] and Commander Dundas explored the Tana and the Juba for the Imperial British East African Company.[2] Captain Lugard, when in Uganda, visited the regions between the three Nyanzas;[3] and Mr. Scott Elliot has described his discoveries in his *Naturalist in Mid-Africa*. Of numerous recent expeditions those of Mr. Chandler, of Dr. Gregory to the Great Rift Valley, and of Dr. Donaldson Smith through Somaliland to Lake Rudolf may be mentioned.

In South Africa Dr. Holub made several interesting expeditions both north and south of the Zambesi. The wanderings of the mighty hunter, Mr. Selous, have been of much use to the British in Matabili and Mashona lands, where the ruins of ancient buildings have attracted explorers like the late Mr. Bent. In the March number of this *Magazine* a note is published of the most recent explorations in the Marotze country.

Joseph Thomson conducted an expedition for the British South Africa Company; but his rapid journey to Sokoto for the Royal Niger Company is perhaps better known.[4] Captain Lugard's dash to Nikki in 1894, when he secured treaties which confirmed the British influence in Borgu, has been graphically described in this *Magazine*;[5] and so has Mr. Robinson's journey to Hausaland.[6]

[1] *S.G.M.*, vii. p. 113. [2] *Ibid.*, ix. p. 113. [3] *Ibid.*, viii. p. 625.
[4] *Ibid.*, ii. p. 577 *et seq.* [5] *Ibid.*, Dec. 1895. [6] *Ibid.*, Jan. 1896.

Many traders, missionaries, and scientific men have gradually extended the knowledge of Africa, first revealed by the pioneer explorers. The number is too great to mention, but their services must be not passed over altogether in silence.

In most of British Africa little but pioneer work has yet been done, except at the Cape and in other settled regions, where surveying has been carried on and systematic topographical and geological surveys have been begun. Accounts of this work in South Africa are given in the *Report of the Sixth International Congress* (pp. 321-360). Wherever the railway lines have been built the knowledge of the country is more detailed, and railways are rapidly being extended towards Matabililand, and in the east from the coast to the Victoria Nyanza.

As regards geographical work in the immediate future, General Chapman's address to the Sixth International Geographical Congress on the mapping of Africa (*Report*, pp. 571-578) emphasises the insufficiency of mere route surveys, which alone are available for very many regions, and the need for the careful mapping of a whole district, so that its configuration can be clearly understood. For the trader as well as the geographer, a knowledge of the geological and economic conditions of the continent is necessary, and as yet only a few of the outstanding facts are known. The climatic data from British Africa are still scanty and for short periods. With the arrival and spread of the European over the continent, the old native conditions and customs are surely, if slowly, undergoing modification, and it is important that the people and their characteristics should be studied before they become greatly changed. While the most important facts of African topography are known at the present day, this cannot be regarded as more than an introduction to the geography of the continent.

America.

A map of the British territory in North America drawn in 1837 would show nearly the whole of the northern coast of the continent from Pt. Turnagain, with the exception of the interval between Pt. Beechy and Pt. Barrow. This gap was filled up in that year by Messrs. Dease and Simpson of the Hudson Bay Company. East of Cape Turnagain there was much uncertainty; King William Land was a name applied to a part of the continent lying at the base of the Boothia Felix and extending across the mouth of the Great Fish river. The eastern shore of Melville Peninsula had been traced out, and Davis Strait and Baffin Bay had been explored roughly up to Smith's Sound. Parry had sailed along the southern coasts of the North Georgian Islands, since renamed after the discoverer, and sighted the north-east coast of Banks' Land and Cape Walker on Russell Island. Wollaston Land appeared on maps as a small strip separated from the continent by the Dolphin and Union Straits. Otherwise there was a total blank from the north and east coast of North Somerset, the east coast of Boothia Felix, and the magnetic Pole on the south-west coast, right across the Arctic Sea westwards.

The map of the British possessions on the continent would, if the dimensions were only that of a medium-sized atlas, appear to be fairly

covered in the south, except in Labrador. The principal lakes would be shown up as far north as Great Bear Lake, and the lakes south of Chesterfield, with incorrect outlines, of course; and the chief rivers flowing into Hudson Bay and those discharging into the Pacific, up to and including Simpson river, would also find a place. In the north-west a blank would be observed between the Mackenzie and Liard rivers, and the Alaskan boundary, balanced on the east by another lying between Bathurst Inlet, Chesterfield Inlet, and King William Land, which would be broken only by Back's Great Fish river. Between the two a few journeys had been made by Franklin and the Hudson Bay Company's officials.

Equally bare would the map of Labrador appear. A few rivers entering the east of Hudson Bay, a series of lakes stretching between Lake Mistassini and the Koksoak river, flowing into Ungava Bay, one or two other lakes draining into the St. Lawrence, Clearwater, and Seal lakes, and a few miles of the Hamilton river, are nearly all the natural features that were then known of the interior.

But even the southern part of the Dominion, though roughly mapped out as described, contained very numerous if comparatively small blanks. A mere skirt of civilisation extended up the St. Lawrence and the shores of Ontario and Erie. Beyond, the country was still the hunting-ground of the Indians, where the trading-posts of the fur companies were the only signs of the white man.

With regard to Arctic exploration at the very commencement of the era, Dease and Simpson led the way with some useful expeditions, passing through the straits named after them, and surveying the coast from Cape Turnagain nearly up to the Murchison river in 1838. Before 1837 the ill-fated Sir John Franklin had made two expeditions, both of them by land. The third one was by sea in 1845, and had for its object the discovery of a north-west passage between Simpson's Strait and Barrow Strait. He sailed southwards between Prince of Wales Land and North Somerset and died off the north-west coast of King William Island. The mournful fate which overtook the intrepid party of explorers is now well ascertained, but for some years it was doubtful; and anxiety about the expedition was the cause of some forty other expeditions being sent to the Polar seas. Of these we may select for notice the expeditions of M'Clintock, M'Clure, Belcher, and Rae, whose names must ever be held in honour in connection with Arctic exploration, for to them we owe much valuable and interesting information as to the conditions of Polar seas and lands. To the first is due the discovery of the fate of Franklin and the exploration of the coast of King William Island, and parts of Boothia and Prince of Wales Island. M'Clure sailed round the greater part of Banks' Land, and travelled thence eastwards with sledges, discovering a north-west passage different from the one which Franklin traced out, while Rae, besides tracing a considerable extent of coast at the south extremity of the Gulf of Boothia, travelled along the south—Victoria and Wollaston Land—in 1851, a year before Collinson sailed round the west, east, and south coasts of this large island. At a later period Hayes, Nares, and Greely resumed the unfinished task, and contributed in no small measure to the solution of the Arctic problems. A minute comparison of the

map of the Polar regions as it was known in 1837 with the map of to-day can alone indicate what we owe to these intrepid explorers, but it also shows how much there is still left to be done. But we are fain to confess that of late years zeal for exploration in the British seas has grown somewhat cold. Perhaps it would be fairer to say that our explorers have transferred their energy to a different sphere.

The earlier explorations on the continent were chiefly carried out by officials of the fur-trading companies, chief among whom was Sir George Simpson, Governor of the Hudson Bay Company, who sent out Thomas Simpson, Dease, Rae, and other explorers, besides travelling himself over considerable parts of the North-West Territories, British Columbia, and Rupert's Land. Of other officials Robert Campbell deserves special mention. In 1838 he established a fort at Dease lake, one of the sources of the Liard river, and passed over to the Stricken river. Soon afterwards, in 1840, he traced the Liard to its source in Francis lake, and, pushing across the watershed, descended to the Pelly river, and in 1843 he explored it to Fort Yukon. He then followed the Porcupine river to its source, crossed over to Peel river, and by the Mackenzie reached Fort Simpson, whence he had started.

The geological survey of Canada was begun early in the era, *i.e.* in 1843, and placed under the management of Sir William Logan. The results are published in annual volumes, which are well mapped and illustrated. The topography of British Columbia has been explored by Dr. Selwyn, Dr. Dawson, and Mr. Bowman. Dr. Bell has explored the tracts between Lake Superior and Hudson's Bay, and also the Lower Athabasca, Nelson, and Churchill rivers. The Lake of the Woods was explored by Lawson, and the Great Bear lake and the country to the north-west between the Mackenzie and Anderson rivers by Petitot, 1865-71. Saskatchewan was thoroughly explored by Captain Palliser, and a good account of its botany and geology was published by his assistants, Hector and Bourgeau. Macoun has published an exhaustive work in which he graphically describes Manitoba and the territories along the North Saskatchewan, Athabasca, and Peace rivers. What Macoun has done for Manitoba Dr. Begg has done for British Columbia.

Much of the exploration work in the Dominion was brought about by the felt necessity for a railway which should cross the length and breadth of the land, and in fact connect the Atlantic with the Pacific. This magnificent project was completed in 1885 in about half the time which had been estimated as necessary for its construction. The Geological Survey has disclosed the welcome fact that throughout the Dominion there is plenty of iron and coal; and, in addition to these, copper, silver, and gold have been found in considerable quantity. Philanthropists and missionaries, while interesting themselves in the physical and spiritual improvement of the aborigines, have not failed to study their habits, legends, ethnography, religion, and language.

Within the last twelve or fifteen years much light has been thrown on the northern parts of the Dominion by various expeditions. Messrs. G. M. Dawson and W. Ogilvie have surveyed a large portion of the

Yukon basin, partly in connection with the delimitation of the Alaskan boundary, Mr. Warburton Pike in 1889-91 travelled to the Barren Grounds north of Great Slave lake, and Mr. J. B. Tyrrell has subsequently made two journeys to the almost untrodden track lying between Churchill river and Chesterfield Inlet.

Naturally the peninsula of Labrador, with its dreary wastes and inclement climate, received little attention at the hands of early explorers. At the commencement of the era under notice, its coastline had been on the whole thoroughly and successfully explored, and some minor expeditions had been made by missionaries, traders, and others into the interior. Of these the most important was that of Michaud to Lake Mistassini, Clouston to Lake Mistassini and the Rupert, East Main, and Nottaway rivers, and Dr. Mendry to the Clearwater and Seal lakes. The earliest explorer of the Victorian era was M'Lean, who succeeded in crossing from Fort Chimo on Ungava Bay to Hamilton Inlet on the east, *via* Michikamow. In a later expedition he discovered the famous Great Fall of the Hamilton river. In 1842 Reads and Spenser explored successfully the territory round Lakes Nitchiguan and Kaniapiskow, after which little seems to have been done in the way of exploration till 1860, when Blaiklock surveyed the Mistassini and Chamonchouan rivers, and the Government undertook the survey of the southern watershed. Hind's expedition up the Moisic in 1862 may be mentioned in passing. After this the principal explorations have been made by members of the Geological Survey, of whom we may mention Messrs. Richardson, Bell, and Low. The last-named officer published an excellent report on the results of the survey up to 1896.

In spite of the efforts of these and other energetic explorers there are still large areas of which comparatively little is known. Perhaps nothing shows more strikingly how much work remains to be done within the limits of the Dominion than the recent discovery by Dr. Bell of a large river lying just beyond the sources of the Ottawa, within a comparatively easy distance of the centres of civilisation. Within the Arctic circle the western shores of Grant Land and Ellesmere Land are still indefinite, and whether there are islands to the west of these and north of the Parry Islands is still unknown. The eastern shores and the interior of Baffin Land have to be explored, and even as far south as Hudson Bay the outlines of Southampton and the neighbouring islands have not been fully drawn, but they will be more thoroughly explored this summer by Dr. Bell. On the mainland the unexplored areas were estimated by Dr. Dawson in 1890 at nearly 100,000 square miles, most of them lying north of the isotherm of 60°, which is the limit of profitable agriculture. Such tracts are to be found in the north-west south of the Yukon and extending to the Mackenzie, and east of the Mackenzie from the Great Bear and Slave lakes to the Arctic Ocean and Hudson Bay, while in the great peninsula of Labrador—though much progress has been made of late, as shown in Dr. Bell's map (*S.G.M.*, 1895)—there are numerous and extensive blanks waiting to be filled in.

A few words will suffice for the other British possessions in America. Most of them being islands of small area they were quickly explored, and

only topographical surveys have been executed within our period. The only exception is Guiana, which extends far inland into the primeval woodlands inhabited solely by Indians. James Hillhouse, in 1837, ascended the Lower Cuyuni, but the most noted explorer in this country was Sir Robert Schomburgk, whose name has lately been frequently mentioned in connection with the Venezuelan boundary. He not only travelled in the western part of the colony, but also on its southern boundary and down the Corentyn river. Mr. Barrington Brown discovered the Kaieteur Falls on the Potaro river, and Mr. Everard im Thurn ascended the Roraima mountain for the first time. Of late the gold discoveries on the Cuyuni and other rivers has lead to many investigations by gold prospectors and others, but the country on the Upper Essequibo and its tributaries is still almost virgin soil for the explorer and the scientific traveller.

Australasia.

Discovered two centuries before, and subsequently reconnoitred in parts by Tasman, Dirk Hartog, and other Dutch navigators, Cook and La Pérouse, the shores of Australia were not systematically explored till the end of last century, chiefly by Bass and Flinders, and as late as 1821 and 1822 many new and important discoveries were made by Captain Philip P. King on the northern and western seaboard. This coast was visited within the Victorian era, 1838-1840, by the *Beagle*, when the Flinders, Albert, Adelaide, and Fitzroy rivers, Port Darwin, and Victoria river were discovered, and with this voyage the general survey of the shores of the continent was completed. Of the interior only a comparatively small portion was known sixty years ago. Bass had visited the Blue mountains; Wentworth, Blaxland, and Lawson had crossed the Australian Alps; Evans had discovered the Macquarie. Oxley, Hume, Lawson, Cunningham, and others had discovered the Goulburn, Brisbane, Dumaresque, Gwydir, and Condamine rivers, the Liverpool plains and Darling Downs. Captain Charles Sturt and Major (afterwards Sir Thomas) Mitchell had penetrated farther into the interior. The former, having reached the upper course of the Darling, sailed down the Murrumbidgee and the Murray, passing on his way the mouth of a large affluent which he believed to be the river he had seen on his former journey—a conclusion proved to be correct by Mitchell in 1836, on his notable expedition through Australia Felix. On the south the Yarra was discovered in 1835 by Batman, and two years later, just sixty years ago, a new settlement on its banks was named Melbourne, while the site of Adelaide was chosen the previous year by Governor Bourke. Thus a skeleton network of routes had been traced over the south-eastern part of the continent from the mouth of the Murray to the Brisbane to serve as a basis for future surveys.

In the west, also, a settlement had been established at Perth, and some short incursions made eastwards; but as the country inland offered few inducements to settlers, the surveyors confined their labours for the most part to the immediate neighbourhood of the colony, the Swan river

and its tributaries. One journey, however, of greater length was made by Captain Bannister, who crossed to King George's Sound.

Only a small fraction of the Australian continent had, therefore, been even superficially explored at the commencement of the period under discussion. But there was no lack of enterprising men, and the work of opening up the interior progressed rapidly. First among the pioneers of the Victorian era was E. J. Eyre, afterwards Governor of Jamaica, who in 1838 travelled from Port Phillip to Adelaide, tracing the Wimmera to Lake Hindmarsh. The next year he left Port Lincoln on the western shore of Spencer's Gulf and discovered Streaky Bay and Lake Torrens, which in 1840 he examined more fully, and in that and the following year marched round the Great Bight to Albany on King George's Sound, enduring great privations. In 1840 also Gippsland was discovered by Angus M'Millan, and in the following year a party led by John Orr explored it more thoroughly.

Again, two men never to be forgotten in the annals of Australian exploration, Sturt and Mitchell, came to the front. The object of Sturt's expedition in 1844-45 was to ascertain whether there was a large lake in the interior of the continent. He penetrated into the heart of the continent, discovering Eyre's Creek and Cooper's Creek, but found no valuable land to reward him for the hardships he endured. At the same time Ludwig Leichhardt made his first expedition from Darling Downs to Port Essington, and before he returned Sir Thomas Mitchell travelled to the Barcoo (or Victoria) river, passing through fine pasture land.

The year 1848 is memorable for two disastrous expeditions, that of Dr. Leichhardt, who, attempting to cross from the Barcoo to Perth in Western Australia, was lost somewhere in the heart of the continent, and the journey of E. B. Kennedy up Cape York peninsula, when some of the party died by starvation, and the leader was murdered by natives not far from Cape York.

The uncertainty as to the fate of Leichhardt called forth several expeditions into the interior, of which the most successful was that of A. C. Gregory in 1855, accompanied by Dr. (Baron von) Mueller, and his brother H. C. Gregory. They travelled across the northern part of Australia to Victoria river in the Northern Territory, as it is now called, crossing the same rivers as Leichhardt on his first expedition, but nearer their sources. They also followed up the Victoria to its source, and, crossing the water-shed to the Sturt Creek, passed several salt lakes and named Mt. Mueller.

In 1858 A. C. Gregory crossed from Queensland to Adelaide in search of Leichhardt, and established the identity of the Barcoo with Cooper's Creek. With a bare mention of the ill-fated expedition of O'Hara Burke, who perished after nearly crossing the continent from Victoria to the Gulf of Capentaria in 1860-61, we must pass on to a review of the work done in South Australia and by expeditions equipped in that colony.

Here Mr. Stephen Hack, in 1857, examined the Gawler range and sighted Lake Gairdner, while Babbage penetrated into the country north

of Lake Torrens, naming several new geographical features, among them Lake Eyre. His claim to this last discovery was afterwards disputed by Major Warburton, who was sent to supersede him.

But the most remarkable journeys were made by J. M'Douall Stuart, who, after several attempts, in which he displayed great tenacity of purpose, patience, and endurance, at last in 1861-62 traversed the continent to the north coast at Van Diemen's Gulf.

In Western Australia the earliest land journeys within our period were made by Lieut. Grey, afterwards Governor of South Australia and subsequently of New Zealand. In 1838, accompanied by Lushington, he discovered the Glenelg river, and ascended it for eighty miles through fertile country. The next year he explored the coast north of Perth, discovering the Gascoyne, Murchison, Hutt, Bower, Buller, Chapman, Greenough, Irwin, Arrowsmith, and Smith rivers. In 1843 Messrs. Landor and Lefroy made a short excursion from York, discovering several shallow lakes—some salt, some fresh. In 1858 Frank Gregory left the Geraldine mine on the Murchison, ascended the river for some distance, and then, striking across the country towards the north-east, reached the Gascoyne, which he explored as well as its tributary the Lyons, so named by him. Another successful expedition was conducted by the same explorer from Nichol Bay on the north-west coast, in 1861, when the Hammersley range, the Fortescue river, and the Ashburton were visited. Returning to Nichol Bay the party again travelled eastwards crossing the Yule, Shaw, and De Grey rivers and ascending the Oakover. They then made an effort to get farther to the east, and nearly lost their lives among the sands and barren rocks they there encountered.

Many other expeditions of less extent, though not altogether unfruitful, must be passed over in silence, and the journeys across the continent between Western Australia and South Australia must be briefly noticed. John Forrest (now Sir John), accompanied by his brother Alexander, travelled by the Great Bight in 1870, and reported that there was fine pastoral country at a distance from the coast. In 1874 the brothers started from the Murchison river and, by Kennedy Creek, Windich and Weld Springs, and Lake Augusta, came to Peake Station on the northern telegraph line. The following year Ernest Giles, who had already made two attempts to cross the desert, being stopped in 1872 by the dry salt lake he named Lake Amadeus, and in 1873 turning back at Gibson's desert, named after one of the party who died there, set out again with Messrs. Tietkins and Young, furnished with a troop of camels by Sir Thomas Elder, and, passing Victoria Springs, reached, not without difficulty and danger, the western colony. He then marched northwards to the Murchison and joined his route of 1873 near the Alfred and Marie range, whence he made his way without further obstacles to the Peake Station. Fourteen years later his companion, Mr. Tietkins, again visited the central part of the continent, named the Kintore range, the Davenport Hills and other elevations, ascertained that Lake Amadeus terminated at Mount Unapproachable, and discovered Lake Macdonald.

Some of the principal journeys to the northern coast started from the east or south and have been already mentioned. Only two more need be

referred to. In 1879 Alex. Forrest led an expedition from the Grey river across the country to Beagle Bay, and followed the coast round to the Fitzroy river, which he ascended for 240 miles. Foiled in an attempt to cross the Leopold range, he found a way round its southern extremity; he followed the Ord river for a time, and then, crossing several other streams, reached the Victoria river. Thence he struck eastward, his intention being to reach the telegraph line, and on this part of the journey the party endured terrible privation, but were at length relieved by a repairing party. An expedition to Arnhem Land was undertaken in 1883 by Mr. David Lindsay, subsequently leader of the Elder Exploring expedition. He started from Palmerston and crossed the Katherine to the country north of the Roper river, and thence advanced to Blue Mud Bay. Much of the country was broken tableland, but on the whole suitable for settlement.

On the whole the exploration of the continent may be said to be completed. It is true that there are large unknown tracts between the routes of Giles and Forrest and northwards to the Fitzroy river, but it is not likely that any country lies between them different in character from the sandy deserts and spinifex-clothed hills traversed by those travellers of the more recent Elder expedition. A few more salt pans may be found, a few more dry or half-dry creeks, and small patches of poor grazing land, and scientific expeditions, such as the Elder and that recently conducted by Mr. Horne, may bring back valuable results. Minerals, of course, may yet be found even in the desert, as in the scarcely less desolate region of Coolgardie, but farther in the interior the want of water will be a still greater obstacle to their exploitation.

With regard to Tasmania there are no such exciting narratives of exploration as are to be found in the geographical history of Australia. Being a small island, and settled as early as 1803, the greater part of Van Diemen's land, as it was called till 1853, was known in general outline by 1837. Sir John Franklin, who became Governor in that year, promoted scientific research with great zeal, and founded the Royal Society of Tasmania. During his term of office several men of note in the scientific world visited the island—Darwin in the *Beagle*, Sir Joseph Hooker, Jukes, and others—and received every assistance the Governor was able to give them. The detailed survey of the country and the exploration of the south-eastern side of the island, which had attracted less attention, was gradually and quietly carried on by Government surveyors and mining prospectors.

Of New Zealand much the same may be said. Colonisation was definitely commenced in 1838, and twelve years later settlements had been formed in both the North and Middle islands. In the early days the Maori showed no distrust of white men, and missionaries and travellers moved freely among them, so that the North Island had been traversed in many directions by missionaries and traders before the arrival of the colonists. The Middle Island, however, seems to have been less frequently visited by Europeans, and, being larger, was not so quickly overrun. Dr. Ernest Dieffenbach, naturalist to the New Zealand Company, travelled in the country during the years 1839 to 1841, chiefly

in North Island, and early in the forties Mr. Kettle travelled in its southern portion and Mr. Cotterell in the neighbourhood of Nelson, Middle Island. Here also Captain J. Lort Stokes, Lieutenant-Governor Eyre (already mentioned as a noted Australian explorer), Mr. Hamilton, and Captain Murray Mitchell did much to open up the country, and a few years later, Brunner, Turnbull Thompson, Rochefort, Dr. Julius Haast, M'Kerrow, Dr. James Hector and other surveyors visited the west and south coasts, and various parts of the island, so that early in the sixties a very fair map could be drawn. Thus exploration went on steadily hand in hand with colonisation, leaving behind it no records of suffering and loss of life such as attended so many of the expeditions through the larger country of Australia, with its parched and sandy deserts. Only detailed work now remains to be accomplished by the Government surveys, as for instance in the Southern Alps, which also possess many attractions for the Alpine climber and the lover of scenery. Here Mr. C. E. Douglas has particularly distinguished himself, and lately Mr. FitzGerald has ascended some hitherto untrodden peaks.

The territory which is now known as British New Guinea was formally annexed to the British Empire in 1888, but previous to that date there had been several expeditions for exploration within the Victorian era. Apparently the first of the era were the marine survey expeditions of H.M.S. *Fly* in 1842-46 and of H.M.S. *Rattlesnake* in 1846-50, which were confined to the coastline. Some missionaries arrived on the island in 1867, and the naval explorations were resumed in 1871 on a more complete scale, when Captain Moresby completely surveyed the east and south-east coast and explored the Usborne and Edith rivers. After this the distinguished naturalist D'Albertis made several expeditions for exploration, and contributed most important additions to our knowledge of the natural history of these regions. There were other explorations by Raffray, M'Leay, and Morton, and last, but by no means least, the well-known Russian de Miklukho Maklai. During the same period New Guinea had attracted the attention of Australian explorers, of whom Armit, Thomas, Morrison, Ebesen, Kerry, and the ill-starred Denton need only be mentioned. No account of exploration in New Guinea would be complete which omitted to mention the valuable work of that excellent missionary, the Rev. J. Chalmers. In 1884 Sir Peter Scratchley was appointed High Commisioner over the south-east of the island, which had been brought under British protection, and before his death in 1885 he had surveyed the whole of the coastline of the new territory and had made one short expedition inland from Port Moresby. During his short term of office he sanctioned expeditions under the auspices of the Australasian Geographical Society under Everill and H. O. Forbes. Captain Everill sailed up the Fly river and also its tributary the Strickland for a distance of about 130 miles. Mr. Forbes explored in the Astrolabe range of hills, and tried, but failed, to reach the top of the Owen Stanley range. In 1887 Cuthbertson was successful in his attempt to ascend to the top of Mount Obree, and there were minor expeditions all more or less successful by Bevan, Henney, and Hennessy. The first Governor of British New Guinea was Sir William M'Gregor,

who lost no time in commencing a systematic tour of exploration in his new dominions. Following the example of Scratchley, he inspected the whole of the coastline, and then he took up the task at which Forbes had failed, and successfully explored the country round the Owen Stanley range and ascended to the top of the principal peaks. In 1889-90 he made a detailed exploration of the Fly river and adjoining country. Rather more than 600 miles of the river were explored. He has also surveyed the coast down to the Dutch boundary, which he has determined in conjunction with a Dutch Commissioner. Last year Sir W. M'Gregor crossed the territory from Traitors' Bay on the north-east coast to the mouth of the Vanapa, the first time the feat has been performed, if we except the attempt of Otto Ehlers, who perished in the Heath river after marching overland from the Huon Gulf. In New Guinea there is still new country to be won; of the Anglo-German boundary little is known except the few elevations that are visible at long distances, and east of the Fly river towards the Dutch territory the interior is practically unknown to Europeans.

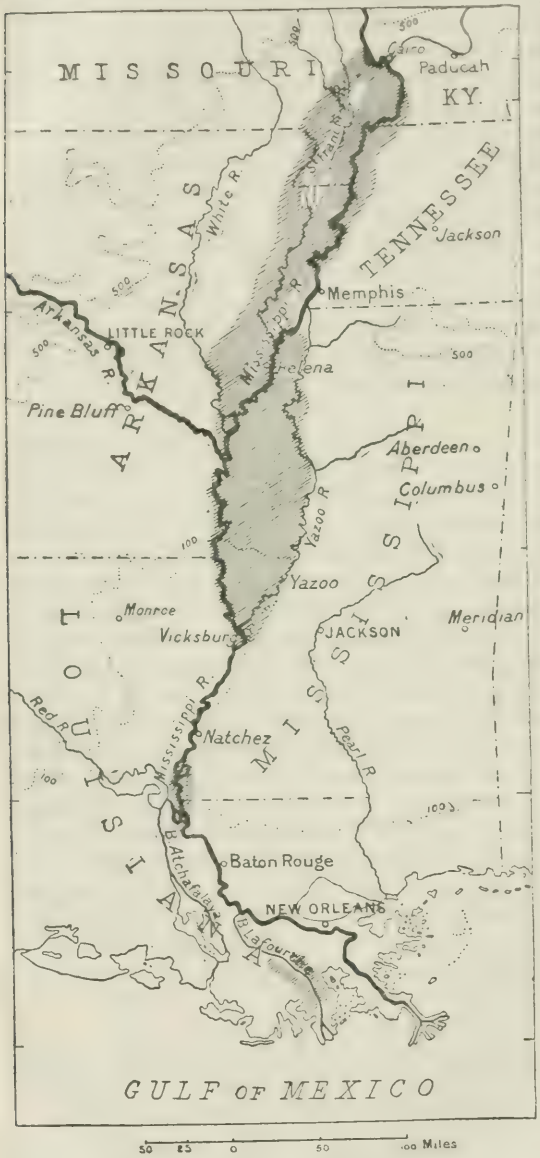
In the foregoing pages we have endeavoured to place before our readers a sketch of what has been done in the way of exploration within the British Empire during the Victorian Era. From the very nature of the subject our sketch must be condensed and summary. But even such a brief outline of the exploration carried out in British territory during the past sixty years indicates what great advances have been made in our knowledge of the topography of the earth's surface. When we consider, in addition, the work that has been done in non-British lands we realise that a new world has been discovered during the Queen's long reign, for most of two continents, Africa and Australia, and vast areas of Asia, America, and Polar lands have been first explored by Europeans since 1837. For the Victorian Era it is claimed, and justly claimed, that the advance made in the sciences has been greater than in any other period of the world's history, and of this the advance made in the science of geography is an undoubted and brilliant illustration. For this we are indebted to intrepid and devoted men who, in all parts of the world, took their lives in their hands, and went forth boldly into unknown regions, where too many of them had to succumb to exposure, to fever, and to savagery. If the blood of the martyrs is the seed of the Church, the blood of its explorers has been the seed of geography.

THE FLOOD OF APRIL 1897 IN THE LOWER MISSISSIPPI.

By Henry Gannett, U.S. Geological Survey.

The river from Cairo to the Gulf of Mexico flows through a broad alluvial region, but slightly elevated above the surface of the river at ordinary stages of water, and below it at high water. In all this course of one thousand miles, as the river flows, it is depositing material, and consequently its immediate banks are, as a rule, higher than the remainder

of the bottomland. Through this long stretch the river is guarded upon either bank by levees, as are also its two principal outlets, the Bayous Atchafalaya and Lafourche, these levees ranging in height from three or four feet up to an extreme of twenty feet. Through this part of its course the slope of the river is very slight, and the river is extremely crooked, shifting, and unstable. The dominant fact in this region is that the surface of the river, when sufficiently high to overflow its immediate banks, is above the level of the adjacent country, so that when it overflows its banks it floods the country far and near. This alluvial region is of great extent, comprising nearly 40,000 square miles. Its breadth is irregular, being quite narrow at its northern end, and generally increasing southward. It extends far up the valleys of the affluents on the west, such as the St. Francis, Arkansas, and Red rivers, and includes all the region between the Mississippi and the Yazoo rivers on the east. In south-eastern Louisiana it broadens out to the westward, so as to include all the region between the Mississippi and its principal downward branch, Atchafalaya Bayou.



MISSISSIPPI FLOODS, APRIL 1897.
(*The flooded parts are shaded.*)

Of this great area the flood of April last covered two-fifths, or an estimated area of nearly 16,000 square miles. One-half of this was in

Mississippi, including nearly all the alluvial region of that state, 4500 square miles in Arkansas, 1750 in Missouri, 1200 in Tennessee, and 450 in Louisiana. The extent of the alluvial region, and the portion of it which was under water at the above date, are shown upon the accompanying map.

Over all this area the crops were destroyed, people rendered homeless, and many were drowned, while the bulk of the population were enabled, by relief steamers and other means, to gain places of safety upon higher ground.

This region contained in 1890 a population of nearly 400,000 persons, more than two-thirds of whom were Negroes. It contained fully 2,000,000 acres of cultivated land, mainly devoted to cotton and maize, and this area produced last year about 370,000 bales of cotton, valued at nearly $13,000,000, and over 11,000,000 bushels of maize, worth about $3,400,000. More than half this product came from that portion of the area lying within the state of Mississippi.

To what extent this disaster will affect the crops of the present year it is impossible to state. The floods have subsided, and the water has filtered away in time to allow the planting of the soil in cotton and corn, but undoubtedly the soils have been injured by the deposition of detritus from the river water, and the effect of this it is at this time not easy to predict.

GOLD IN THE YUKON DISTRICT.

Dr. Begg's article on the Yukon country in the *Magazine* for November 1896 will have prepared members for the tales with which the newspapers have recently been full, of fortunate gold-seekers returning with suddenly acquired fortunes from this far-off region. Even if such tales as each shovelful of dirt in some regions being worth 16s. be not true, it seems certain that such fortunes as are now being made by a fortunate few have not been rivalled since the prosperous mining days of the middle of the century. The gold is found not only in the bed of the stream, but great veins of auriferous quartz, ten to thirty feet wide, are reported to have been discovered in the Klondike district, whither all the miners in the Yukon valley, and hundreds of adventurers from the west of Canada and the States, as well as farther afield, are pushing on as fast as they can in a region where means of transport are very deficient.

The difficulty of reaching the Yukon district, the hardships of the winter, and the fact that every necessity of life is very dear, having to be brought by these long and difficult routes, must be emphasised. There are two routes which are usually taken to reach the Upper Yukon. One is by steamer to the Yukon river, where a stern-wheeled steamer can make the journey up the river, which lasts nearly three weeks, twice in the season. This has been described by Dr. Begg (*S.G.M.*, xii. pp. 554-555). The other is to Juneau City, on the Lynn Canal, Alaska, whence the traveller must cross the difficult Chilkoot Pass, or the lower

and easier, if longer, White Pass, to the Lewes and Pelly rivers, where canoes or boats are used for journeying northwards seven or eight hundred miles to the gold regions of Forty-Mile Creek and Klondike, a much shorter route than the other, and taking little over a fortnight from Juneau City. A new route, entirely within British territory, is described by Dr. Begg in the March number of the *Magazine*. (See Map of Alaska, *S.G.M.*, vol. x. p. 412, for Forty-Mile Creek, Chilkoot, and Juneau. Fort Cudahy will be found on the Polar map published with Dr. Nansen's paper in May 1897.)

The Klondike or Deer river is in British territory, but not very far from the boundary with Alaska. It is not, however, in British Columbia as most newspapers mention, but in the Yukon district to the north of it; 50 miles from Fort Cudahy.

Dr. Dawson of the Canadian Geological Survey explored this region ten years ago, and the geographical results of his expedition were noticed in the *Magazine* at the time (v. 440). An extract from the part of his report dealing with the gold in the region is interesting at the present moment.

"Taking a general view of the gold discoveries so far as made in the Upper Yukon country, we find that, though some small bars have been worked on the upper part of the Lewes, and 'prospects' have been obtained even in the streams flowing into Bennett Lake, paying bars have been found on this river only below the mouth of the Tes-lin-too. The best of these are within a distance of above seventy miles below this confluence, and the richest so far has been Cassiar Bar. This is reported to have yielded, in some cases, at the rate of $30 a day to the hand, and gold to the value of many thousand dollars has been obtained from it, chiefly in 1886. In 1887 only three or four men worked here. All along the Lewes below the Tes-lin-too, many bars occur which, according to the reports of prospectors, yield as much as $10 a day; and the same is true of the Tes-lin-too itself, both below and above Tes-lin Lake. Bars of this kind are, however, considered scarcely remunerative at present.

"Gold has also been found for a long distance up the Big Salmon River, and on the Upper Pelly as far as it has been prospected. The Tes-lin-too, Big Salmon, and Pelly have each already afforded some good paying ground, but in consequence of the rush to Forty-Mile Creek only about thirteen miners remained in 1887 on the first-named river, four on the second, and two on the Pelly. On the Stewart River, as much as $100 a day to the hand was obtained in 1885 and 1886, and probably over $100,000 worth of gold has already been obtained along this stream. It has been prospected for a distance of 100 to 200 miles from its mouth (according to varying statements), and the gold found farthest up is said to be somewhat 'coarser' than that of the lower part.

"Forty-Mile Creek is reported to be a river of some size,[1] but more rapid than most of those in the district. It has, according to miners, been prospected for about 100 miles from its mouth, gold being found almost everywhere along it as well as in tributary gulches. The gold varies much in character, but is quite often coarse and nuggety, and very large amounts have been taken out in favourable places by individual miners. Few of the men mining here in 1887 were content with ground yielding less than $14 a day, and several had taken out nearly $100

[1] 360 miles long, and 150 yards wide at its mouth.

a day for a short time. The amount obtained from this stream in 1887 is reckoned by some as high as $120,000, but I believe it would be safe to put the entire output of the Upper Yukon region for the year at a minimum of $75,000, of which the greatest part was derived from this stream.

"The number of miners in the whole Upper Yukon country in 1887 may be stated at about 250; of these, 200 were on Forty-Mile Creek, and it was estimated that at least 100 would winter on the creek to be ready for work in the spring.

"Forty-Mile Creek is what the miners terms a 'bed-rock creek'—*i.e.* one in which there is no great depth of drift or detrital deposits below the level of the actual stream. It is so far the only locality which has been found to yield 'coarse gold,' but from the extremely wide distribution of 'fine gold,' it may safely be predicted that many more like it remain to be discovered.

"Mining can scarcely be said to have begun in the region more than five years ago, and the extent of country over which gold has been found in greater or less quantity is already very great. Most of the prospecting has been confined to the banks and bars of the larger rivers, and it is only when their innumerable tributary streams begin to be closely searched, that 'gulch diggings' like those of Dease, M'Dame, and other streams in the Cassiar district, and possibly even on a par with Williams and Lightning Creeks in Cariboo, will be found and worked. The general result so far has been to prove that six large and long rivers—the Lewes, Tes-lin-too, Big Salmon, Pelly, Stewart, and White—yield 'fine gold' along hundred of miles of their lower courses. With the exception of the Lewes, no part of the headwaters of any of these have yet been prospected or even reached by the miners, and scarcely any of their innumerable tributaries have been examined. The developments made up to this time are sufficient to show that when means of access are improved, important bar-mining will take place along all these main rivers, and there is every reason to anticipate that the result of the examination in detail of the smaller streams will be the discovery of much richer auriferous alluviums. When these have been found and worked, quartz mining will doubtless follow, and the prospects for the utilisation of this great mining field in the near future appear to me to be very promising."

At the end of last year, Inspector Constantine, of the North-West Mounted Police, stationed at Fort Cudahy, reported as follows:—

"The running of the boundary line last winter determined the fact that gold-bearing creeks which hitherto were supposed to be in American territory are wholly, or in part, in Canada, the two principal ones being Miller and Glacier. Notice was sent the miners that these, as well as certain other creeks specified in the notice, were in Canada, and subject to her jurisdiction and laws. This was cheerfully accepted, and mining regulations adhered to and all the necessary Government fees paid.

"A few miners denied Canada's jurisdiction and right to collect fees, on the ground that there was no joint survey and a possibility of error in the work. However, I went up to Miller and Glacier Creeks, and all dues were paid without any trouble, except that of a hard trip; but as all trips in this country are of that nature, it was part of the bargain. On Glacier Creek, a number of the miners undertook to run matters in accordance with their ideas of justice, and set themselves up as the law of the land. The trouble ended, however, by the Canadian law being carried out.

"As far as I can learn, the amount of gold taken out this season is about

$300,000, or 17,647 oz., chiefly from Miller and Glacier Creeks. This is a slight increase on last year.

"In August of this year a rich discovery of coarse gold was made by one George Carmack on Bonanza Creek, a tributary to the Klondike or Trondec River, which flows into the Yukon River about fifty miles from here, entering from the south-east. His prospect showed $3 to the pan. As usual, such a prospect created a stampede for the new diggings. Men left their old claims, and with a blanket, axe, and a few hard-tack, prospected on the new creek, staked and registered their claims, which, in all cases, gave better prospects than any other heretofore. Many old miners state that this creek is fully as rich as any found in California in the early days. New creeks are being found daily, all prospecting well. Three hundred and thirty-eight claims have been registered to date, and there still remain about 150 to be entered.

"The country between Hunker Creek and M'Questen River, which empties into the Stewart River, is full of small creeks and gulches, which, on being prospected, have all given good results. It is probable that the gold-belt will in time be found to extend from the Klondike to the Cassiar, and that the whole of this to the Divide will prove to be rich in gold. Without doubt, before long rich quartz will be found, but not worked until some means of transporting the necessary heavy machinery is provided, and supplies can be got in at reasonable cost. The gold-bearing creeks in Canadian territory on the west side of the Yukon are as follows :—Gold, Miller, and Glacier Creeks, all but one mile of bed-rock ; Moose and the first fork of Moose Creek, one mile of the three heads of Smith Creek, and of the several heads of Canyon Creek, about one mile of the Poker and Davis branches of Walker Creek, one and a half miles of Walker Creek.

"On the east side of the Yukon are the following creeks :—Bonanza, Boulder, Adams, Eldorado, Victoria, Carmack, Bear, Last Chance, Hunker, Gold Bottom, and Baker Creeks. These latter creeks are all of a fair size, with a good supply of water for mining purposes, and easy of access.

"Bonanza is a large creek, and it is possible there may be too much water to be easily worked in the spring.

"A new post should be built in the spring at the mouth of the Klondike River, which flows into the Yukon on the east side about fifty-three miles south-east of Forty-Mile. This point will be the base of supplies for the new diggings, and will, in all probability, be the largest camp in the country. Nearly 350 claims[1] have been already registered in this district. As the average number of men required to work a claim is five, it means a camp of nearly 2000 workers, as well as the usual number of camp followers."

Mr. Ogilvie, the surveyor in charge of the Canadian Geological Survey in the Yukon district, whose earlier reports have been noticed by Dr. Begg, has described the extraordinary finds of gold in the Klondike district.

"Since my last, the prospects on Bonanza Creek and tributaries are increasing in richness and extent, until now it is certain that millions will be taken out of the district in the next few years.

"On some of the claims prospected the pay-dirt is of great extent, and very rich. One man told me yesterday that he washed a single pan of dirt on one of

[1] Creek and river claims in the Yukon district are 500 feet long, and extend in width from base to base of the hill or bench on each side.

the claims in Bonanza Creek, and found $14.25 in it. Of course that may be an exceptionally rich pan, but $5 to $7 per pan is the average on that claim, it is reported, with five feet of pay-dirt, and the width yet undetermined, but it is known to be thirty feet; even at that figure, the result, at nine to ten pans to the cubic foot, and 500 feet long, would reach $4,000,000 at $5 per pan—one-fourth of this would be enormous.

"Another claim has been prospected to such an extent that it is known there is about five feet of pay-dirt, averaging $2 per pan, width not less than thirty feet. Enough prospecting has been done to show there are at least fifteen miles of this extraordinary richness, and the indications are that we will have three or four times that extent, if not all equal to the above, at least very rich. There is intense excitement here, and every one who can is staking claims."

"The reports from the Klondike regions are still very encouraging; so much so that all the other creeks around are practically abandoned, especially those on the head of Forty-Mile Creek, in American territory; and nearly a hundred men have made their way up from Circle City, hauling their sleds themselves many of them. Those who cannot get claims are buying in on those already located. Men cannot be got to work for love or money. One and a half dollars per hour is the wage paid the few men who hire for work, and work as many hours as you like. Some of the claims are so rich that every night a few pans of dirt suffice to pay the hired help when there is any. Claim owners are now very reticent about what they get, so you can hardly credit anything you hear; but one thing is certain: we have one of the richest mining areas ever found, with a fair prospect that we have not yet discovered its limits. Miller and Glacier Creeks, at the head of Sixty-Mile River, were thought to be very rich, but they are poor both in quality and quantity compared with Klondike. Chicken Creek, on the head of Forty-Mile, in Alaska, discovered a year ago, and rated very high, is to-day practically abandoned."

"A quartz lode showing free gold has been located on one of the creeks. The quartz, I understand from a reliable source, is rich, as tested over $100 to the ton. The lode appears to run from three to eight feet in thickness, and lies about nineteen miles from the Yukon River. Coal is found on the upper part of Klondike, so that the facilities for working are good and convenient.

"Placer prospects continue more and more encouraging. It is beyond doubt that three pans on different claims on Eldorado Creek turned out $204, $212, and $216; but it must be borne in mind that there were only three such pans, though there were many running from $10 to $50."

A vivid picture is given of the conditions of existence in this region in a report by Inspector Constantine.

"In a country where a man has to pole up a rapid river for some hundreds of miles in summer, then pack his food, clothing, camping and working tools on his back, or in winter either haul them himself or with dog, consideration as to where he can get his food and clothing is of vital importance to him, and he is governed accordingly. This accounts for the number of men working on the Forty-Mile and creeks emptying into it. Even here food has to be packed on men's backs in the summer at a charge of 30 cents per pound, and in winter by dogs at 10 cents per pound. This is for about 85 miles. The outlook for the coming year is more promising than that of last year."

With thousands of immigrants to such a region, which produces nothing, which is impassable in winter, where traders give no credit, the

conditions cannot be very satisfactory in the coming cold season. But this does not deter the fortune-hunters.

The Canadian Government have recently issued a pamphlet on the Yukon district, from which most of our quotations have been taken. They also print a warning that those going to the new gold-fields should be plentifully supplied with money before starting. It is now too late to reach Klondike from this country before winter sets in.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Members of the Franco-Scottish Society were invited by the Council to make use of the Society's Rooms during their meetings in Edinburgh, from 12th to 17th July; and a similar privilege was extended to the Geologists' Association, whose meetings were held between 26th and 31st July.

Closing of the Rooms.

The Society's Rooms will be closed during August for cleaning, etc.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Cantabrian Mountains.—Professor Penck has written a short notice on these mountains and their relation to the Pyrenees in the *Geogr. Zeitschrift*, Jahrg. iii. Heft 5. The observations on which it is based are, many of them, those of the Comte de Saint-Saud, who visited the Picos de Europa and the Southern Pyrenees, accompanied by Paul Labrouche, and described them in the *Tour du Monde* of 1894 and the *Revue des Pyrénées* of 1895. The culminating point of the Picos is not, it seems, the Peña Vieja, as usually indicated on maps, but the Torre de Cerredo (8668 feet), which stands on the boundary between Leon and Oviedo, halfway between the Peña Vieja and the Cares valley. Torre de Llambrion is the second peak, with a height of 8658 feet, while Peña Vieja holds only the third place, with a height of 8579 feet. The western section attains a height not much less, while on the east the Andara group reaches only 8022 feet.

The Picos de Europa are wild Karst highlands, with deeply eroded valleys and numerous hollows between the summits, here and there expanding into caldron-shaped valleys. Small glaciers lie in the shelter of the peaks, all of which owe their existence solely to orographical conditions, and therefore the snow limit on these mountains may be placed rather low—8500 feet or lower.

With regard to the Pyrenees, the two travellers divide them into the Continental Pyrenees, separating Spain from France, and the Maritime or Cantabrian Pyrenees, along the Bay of Biscay. The saddle of Aspiroz in Guipuzcoa (1860 feet) is regarded as their meeting-point. The Cantabrian Pyrenees are

divided into Basque, Asturian, and Galician. There is also a chain stretching for a distance of 1200 miles from Cape Ortegal to Cape Creus on the Mediterranean, the independence of which is insisted upon by M. Labrouche. Other geographers have expressed the same opinion—among them Th. Fischer, who regards the Pyrenees and Cantabrian mountains as a connected system formed by folding, and assigns the Galician highlands to the block elevations of the Iberian peninsula.

Suess, following Macpherson, distinguishes three forms in the peninsula—the Meseta in the middle, the Betic cordillera in the south, and the Pyrenees in the north-east. While the two latter are folded elevations, the former is a true *massif*. The *massifs* of Europe show signs of a continued upheaval during the Mesozoic period, and are marked by the occurrence of continental formations; whereas, in the folded mountains, a great development of certain deposits of marine origin is observed. The Eastern Alps exhibit a thick mass of Triassic deposits, the Western Alps of Jurassic strata, and the Pyrenees of the Cretaceous system and the Eocene. The Cretaceous deposits of the Southern Pyrenees extend into the Basque country, their anticlinal dipping into the Gulf of Biscay west of Bilbao, while an inlying shallow basin of Eocene deposits stretches westward to the Gobia valley. In the same direction of strike, marine Eocene deposits appear again near Santander, which have evidently been separated by denudation from those of the Ebro basin. These continue along the north side of the Cantabrian mountains to the Cretaceous ridges of Oviedo, and are associated by Suess with the Pyrenees, while he connects the Cantabrian mountains with the Meseta.

Certainly elevations of Cretaceous age join on to the Cantabrian mountains south of the Basque Eocene basin, and extensive Cretaceous formations appear on their southern flanks. But these are of a different horizon. They belong to the Wealden beds, which are not found in the Pyrenees, while they occur on the other side of the Iberian *massif*, in Portugal. The Cantabrian mountains, with the Picos de Europa, are entirely alien from the Pyrenees ranges. In Eocene times the two systems were separated by a narrow strait, and were only connected in later times by the formation of a water-parting ridge. The tectonic continuation of the Cantabrian range is to be found in the sierras of La Demanda, Urbion, and Moncayo.

Thessaly.—As a rule, Thessaly is represented as a basin, and it is, indeed, a hollow surrounded by mountains, but is divided into three separate plains by continuous ranges of hills. On the west, the Pindus mountains so completely separate Thessaly from Epirus that no close connection between these countries is possible; for armies the only route lies over the Zygos pass in the extreme north. On the east, the East Thessalian mountains form a wall shutting the country off from the Ægean Sea. The lofty Olympus is joined by the equally grand Ossa, and thence Pelion stretches far south into the peninsula of Magnesia, a gently contoured and fruitful ridge of crystalline schists, and one of the most densely-peopled and richest districts of Greece, having in the character of the country and its people only a very slight connection with Thessaly. The mountain-barrier is broken only by the vale of Tempe, through which the Peneius flows, and this opening is insufficient to mitigate the exclusion of Thessaly from the coast, where, moreover, there are hardly any harbours.

At the northern boundary the Khassia, a broad, hilly country of Tertiary formation, joins on to the Pindus range, and affords a fairly easy entrance into Thessaly. But the importance of this route is diminished, in so far as it leads into Thessaly from a secluded valley enclosed by high mountains—that of the Upper Haliacmon. Between the Khassia highlands and Olympus stretches a complicated

mass of folded elevations, known as the Kambunic mountains, embracing a basin filled with low hills, whence the Xerias flows to the Peneius. The northern branch, forming the watershed between the Peneius and the Haliacmon, attains considerable heights—up to 6160 feet. The Xerias, therefore (the ancient Perrhæbia), belongs entirely to Thessaly, and was always considered as within its bounds until the delimitation of 1881. Through this, the most important gate of Thessaly, a road runs from the Haliacmon valley, crossing the northern range, the natural frontier, by a pass 3113 feet high, and thence, avoiding the long detour of the Xerias valley, reaches the plain of Larissa by the Meluna pass, 1700 feet above sea-level. The frontier, following the southern range, and leaving the Xerias basin to Turkey, gives the Turks a decided strategic advantage. Mount Othrys, skirting Thessaly on the south, is on the east but a gentle undulation with broad plateaus; and the Furka pass, leading southwards to Lamia, is only 2625 feet high.

Between the east end of Othrys and the peninsula of Magnesia lies a narrow channel which expands into the gulf of Volo, where alone Thessaly communicates freely with the sea. The smallest of the three basins of Thessaly, the plain of Halmyros, abuts on the gulf. A low, continuous range of hills, the Tsiragiotic, ends at the northern shore of the gulf, and separates the basin from the two other divisions of Thessaly. From the Tsiragiotic hills, the Central Thessalian mountains—isolated hills of crystalline and Mesozoic rocks rising from a broad swell of the ground—run north-westwards to the Kambunic range, separating the larger western plain of Trikhala from the smaller, eastern one of Larissa.

Both plains have an almost entirely horizontal surface of fruitful loam, and run close up to the encircling mountains. In the western plain a large number of streams, bringing down abundant water from the western and southern mountains, converge to a point where they join the Peneius, which winds through the Central mountains, and, collecting the drainage of the water of the eastern plain, passes through the vale of Tempe to the Ægean sea. The southern part of the eastern basin is only imperfectly drained, the water being dammed up into a shallow lake, the Karla (Boebeis), and flowing off through a sluggish, swampy stream, the Asmakion, to the Peneius. The scenery of the Thessalian plains is very monotonous, in consequence, chiefly, of absence of variety in the vegetation, which, again, is the result of climatic conditions. Lying at a low elevation, 330 feet on an average, the inland country of Thessaly has the dry and hot summer of the Mediterranean, and, being shut off from the sea by mountains, very cold winters. Severe frosts are not infrequent. Consequently, the evergreen trees of the Mediterranean region are banished from the plains, though they flourish on the coast. On the other hand, the trees and bushes, which in their summer dress of green give the mountain slopes a Central European character, are kept out of the low country by the deficiency of the rainfall. Except along the river banks, where planes, poplars, willows, and other trees find moisture for their roots, the vegetation is that of the steppe. Covered in winter with a carpet of grass and herbs, in summer the country is dried up and desolate. In the winter half of the year are seen at long intervals the small huts of the herdsmen, usually in groups and surrounded by hurdles, and here and there are grazing cattle watched by wild-looking men in rough sheepskins, just as in the Hungarian Pussta or the South Russian steppes. A large part of the plain, however, is arable land, and is studded here and there with wretched villages of mud huts on either side of miry streets.

Various races have from time to time invaded Thessaly, and the population is therefore very mixed. At the present day, however, only Greek is spoken by the settled agricultural people of the plains. These peasants mostly belong to the tribe of the Karagunides, distinguished from other Greeks by a peculiar costume

and many customs, such as the purchase of wives. The landowners, under Turkish rule Mohammedans, especially Albanians, are now for the most part Greeks. In the towns Spanish Jews and Vlachs, who have gradually returned from the mountains where they sought refuge from the Turks, ply various trades and crafts. The most interesting element is the nomad population. The stationary inhabitants cannot keep any large number of cattle owing to the dry summers, and therefore the winter pastures—partly fallow lands, partly fields which can only be utilised for summer crops, such as maize—are grazed by herdsmen from a distance, who pay a rent to the owners. Some of these herdsmen wander about only in summer, living in huts made of wands or reeds. Most of them are Vlachs from the Pindus mountains, and have certain defined pasture grounds. The pure nomads live sometimes in tents, sometimes in huts, and belong to several tribes, some speaking Aromunian, others Greek.

The material condition of the country is by no means brilliant. The withdrawal of the Mohammedan peasants has left much of the land uncultivated. High taxes, the land system of the Turks which the Greek administration could not at once arbitrarily remove, and the absenteeism of the landlords, have combined to reduce the inhabitants to poverty and squalor. Still, within the last ten years there have been signs of improvement, notably in the increased production of corn and in the growing prosperity of the towns. Wheat, barley, and maize are the chief products of the plains, which are exceedingly fertile, and capable under better management, and with a larger population, of producing most of the corn required for consumption in Greece. Excellent tobacco is grown and a little cotton. Olives and southern fruits are confined to the coast, and there is a considerable exportation of hides, wool, cheese, etc. to other parts of Greece.

Larissa, which was the most important town under Turkish rule, has declined in the number of its inhabitants and in prosperity. Trikhala, on the other hand, situated in the northern part of the western plain, where the roads from Upper Macedonia, Epirus, and the Pindus valleys meet, is progressing. It has now 14,800 inhabitants. Volo also, the port for the export and import trade of Thessaly, has made great strides. In 1889 it had 11,000 inhabitants, and the number has risen to nearly 20,000, or, rather, the town had nearly this number before the war. —Dr. Philippson in the *Geographische Zeitschrift*, June.

ASIA.

The Trans-Siberian Railway.—M. Venukof gives in the *Revue de Géographie* for June an account of the progress of this railway. In Western Siberia the last important work, the construction of a bridge over the Ob, has been terminated, so that there is no change of trains at this point for passengers or goods. On the middle section the bridge over the Chulym river has been completed, and the journey to Krasnoiarsk is now uninterrupted. East of the Yenisei, where there are large tracts of forest, 620 acres of old timber have been felled, and 56½ million cubic feet of earth have been distributed along the track. Bridges have been built over seventy-seven small streams, and the immense bridge over the Yenisei has been commenced; 2100 tons of iron have already been deposited beside the river, as well as the iron for the bridges over the Birussa, Iia, Oka, and Bielaia. Rails are already laid for eighty miles beyond the Yenisei, and workmen's trains run over them.

Between Irkutsk and Lake Baikal 445 acres of forest have been cleared, and in the trans-Baikal district 250 acres. Some embankments have been made in both sections, and on the latter about ten miles of rails have been laid. The bridges,

except two of the largest, are finished. The construction of the Amur line has been postponed, and the Manchurian railway, shorter and easier of construction, will be proceeded with. The preliminary surveys have already been made; according to the convention with China it must be completed in 1903.

A large steam ferry-boat to carry trains across Lake Baikal is being put together at Listvenichnoie, and the quays are being constructed on both sides of the lake. Steamboats are also being provided for the transport of men and goods on the Shilka, Amur, and Ussuri until the railway is completed. A quay of granite is being built at Vladivostok for sea-going vessels. On the Vladivostok-Khabarovka line passengers and goods are forwarded as far as Iman; farther north only workmen's trains run, as the bridges over the Bikin and Khor are still unfinished.

Sumatra.—The triangulation of the west coast of Sumatra, commenced in May 1883, was completed in September of last year. The network is also extended over a small part of the east coast—the east of the department of Laboehan Batoe—and also over the southern part of the Toba lake. The network has 1657 points, 59 being of the first order. Of these 1599 are on the mainland of the West Coast province, which has a surface of 997 square geographical miles (15 linear miles to a degree), so that there is a point to ·62 square mile on an average. The triangulation has been founded on the base measured in 1883 at Padang, and the geographical co-ordinates are reckoned from the west end of that base. In 1896 another determination of latitude and azimuth was executed at the station Tor Batoe na Goelang in the department Padang Lawas of the Tapanoeli Residency, and the difference of latitude between the two points was found to be 2° 36′. Between this value and the latitude deduced from triangulation there is a discrepancy of 1·78″, the greater part of which is due to the difference between the Bessel ellipsoid and the true geoid. The azimuth deduced from the triangulation varies from that given by direct observation by 1·48″. The standard level was fixed by J. L. Cluysenaer at Padang in 1874, and was checked by observations at Si Bolga in 1889. The difference was 33½ inches, which is regarded as a satisfactory result, seeing that the distance in a straight line between the two points is 217 miles.

The triangulation of South Sumatra was commenced in 1895 in the Lampong Residency. At first it was intended to make use of the points of first order fixed in 1868 and 1869, but the pillars had fallen into decay or were destroyed, and therefore the network has been connected with three points in Java. The latitude and azimuth are to be determined astronomically at one of the points of first order as a basis for the reckoning of the co-ordinates, and the standard level by observations at Telok Betong which will be afterwards controlled by a determination of the sea-level at Bengkoelen. The primary network has already been completed in the Redjang district, and part of the Lampong Residency has been surveyed in detail.—*Tijdskrift van het k.k. Nederl. Aardrijksk. Genoot.*, May.

Krakatau and Langeiland.—In June and July of 1896 a detachment of the triangulation brigade went to Krakatau with the object of erecting a pillar on the summit, fully 2600 feet high, in place of the one destroyed by the eruption of 1883. All attempts to reach the top failed, however. The whole surface is covered with a layer of ash some 30 feet thick, which has been carved out by the rain into ravines with vertical sides. Even with ladders the party were unable to overcome these obstacles, and, if they had succeeded, it would have been quite impossible to carry up building materials, water, provisions, and an alt-azimuth instrument. Instead of Krakatau, then, the party had recourse to Langeiland, and a pillar was erected on the ridge which traverses the island and rises about

430 feet above the sea. The sojourn on the island was anything but agreeable. By day the heat was great, the thermometer in the hut rising day after day to 93° F., and falling at night not lower than 86°; the sand was heated by the sun at mid-day to quite 140°. The health of the party suffered; after the rains set in coughs were general, and the natives were attacked also by beri-beri and colic. Water had to be brought from Batavia, for there was no running water on the island, and what was obtained by digging proved to be too full of organic matter to be fit for drinking.

The vegetation is still in a state of development. The trees are as yet young, and consist chiefly of *Casuarina*, which is beginning to form groves near the strand. The most common form is *yelagah*, a kind of tall grass. The fauna is represented by some lizards (*Varanidæ*). On the shore lie large masses of pumice-stone, and the whole island is covered with ashes eroded, as on Krakatau, into innumerable small ravines with vertical walls 130 to 160 feet high. These walls are cased with a thin crust of *algæ* which preserves them from denudation. Degradation therefore takes place through the water that filters down into the ash; and the bottoms of the ravines at their broadest parts, as, for instance, at the mouth, are flat and nearly horizontal. If one advances up the ravines, their windings soon shut him off from the outer world. Here and there on the ground lie fragments of large trunks, quite decayed, the miserable remnants of the dense forest that covered the island before it was buried in ashes; and lapilli are seen and heavy stones, sometimes high up in the walls of ash, which were no doubt ejected by the eruption of Krakatau.

From the height of the ridge the steep northern slope of Krakatau is clearly visible. During the time the party stayed on the island no sign of volcanic action was observed. Landslips occurred daily, and the noise of their fall was plainly heard at the distance of 3½ miles. At the same time, clouds of brownish-red dust rose high into the air where they hung for a considerable time. Probably they have been mistaken for smoke by passing vessels, and hence the reports in Batavian newspapers that Krakatau was again active. The craters of Krakatau—the Danan and Parboeatan—have vanished, and their sites are occupied by calm, blue sea. Beside Langeiland stands the precipitous Bootman's rock, the sole remains of the submerged northern part of Krakatau.—J. J. A. Muller in the *Tijdskrift van het k.k. Nederl. Aardrijksk. Genoot.*, May.

AFRICA.

The Fisheries of Algeria.—Professor Augustin Bernard has sent us a paper on maritime colonisation in Algeria, reprinted from *L'Algérie Nouvelle*. The shores of the possession extend for a length of 700 nautical miles, and in all this distance only five large bays are to be found—those of Oran, Algiers, Bougie, Philippeville, and Bône. The submarine plateau is narrow, and soundings of over 100 fathoms are met with near to the shore; the large banks, lying at some little distance in the bays, approach the coast where the mountains are abrupt. Fish is plentiful. The stationary species are much the same as those that live on the southern shores of France; the migratory kinds are abundant, being principally sardines and archovies, tunnies, bonitos, and mackerel. Coral and sponges exist at many places. The total produce of the fisheries of Algeria is valued at nearly £120,000. Coral fishing, formerly so important, has declined; it is now pursued only on the banks of La Calle between Cape Rosas and Bizerta, and produces not more than £10,000. Oysters are of no importance, while sponges are not collected on the Algerian coasts, being much inferior to those of Tunis. It is estimated that

four-fifths of the fish caught off the Algerian coasts are consumed fresh in the country. Tunnies, lobsters, and shrimps are exported uncured to Marseilles, and salt fish and preserved sardines, anchovies, and bonitos are despatched to Spain, France, Italy, and even America.

The industry gives occupation to 4160 fishermen, who own 1106 boats of an aggregate tonnage of 3781. These are Italians from Sicily, Sardinia, and the west coast of Italy, Spaniards and Maltese, Frenchmen being very few. Formerly these men came over for the fishing season, bringing with them their nets, salt, and provisions, and took back with them the profits of their industry. But since 1888, when a law was passed prohibiting foreigners from fishing in Algerian waters, most of them have become naturalised, and it is hoped that in time they will learn to regard themselves as Frenchmen.

There is plenty of room for a larger fishing population, and strenuous efforts have been made by the Government to establish French fishermen in the Matifou region, at Jean Bart, Surcouf, and La Pérouse. The Government pays the passage of the whole family, gives it a house, garden, and an allotment of nearly fifty acres of ground, with £8 to cover the initial expenses; and a boat, with nets and other fishing tackle, is placed at the disposal of two families in common. The house, land, and share of the boat, etc., become the absolute property of the family after five years of residence. These villages have cost in all fully £12,000, or more than £400 a family, and yet have not been successful. Some of the families have left, and the remainder are constantly complaining of their condition, asking for new nets to replace those they have lost or allowed to decay, and quarrelling over the division of their catch and the fishing stations. It is feared, moreover, that when their five years have expired, and they become proprietors, which will happen this year, the fishermen will dispose of their property to naturalised Italians, and return to their own country. M. Bernard hopes for better things, and believes that the experiment will not be altogether a failure. In the future he recommends that men should be sought for who own boats and have some little capital, and that the Government should confine its assistance to giving instruction on the mode of fishing, the kinds of nets required, and the most favourable fishing grounds, etc.

Mean Altitude of Madagascar.—Prof. Olinto Marinelli has calculated the mean height of Madagascar from planimetric measurements, taking as his basis the hypsometrical map published in the *Annales de Géographie* in 1895, on which the contours are drawn for 150, 300, 500, 800, 1500, and 2000 mètres. The northern and southern parts of the island, lying on either side of the parallel of 20° S. lat., are taken separately. From Prof. Marinelli's tables it appears that in the northern division the larger areas lie below 150 mètres and between 800 and 1500, the percentages of the whole surface being 35 and 27 respectively. In the southern division the percentages are 19 and 36, and there is a considerable area, 20 per cent., between 500 and 800 mètres. Only 4 per cent. of the whole surface of the island (nearly 229,000 square miles) lies at a greater altitude than 1500 mètres (4900 feet), the elevations rising rapidly from this level to the culminating peaks, the highest of which is Tsiafaiavana, 8635 feet.

Prof. Marinelli finds for the mean altitude of the northern section the value 1795 feet, for the southern portion 2211, and for the whole island 1975. The mean height of the island is 23 per cent. of its maximum. This value far exceeds that of any of the continents—the nearest, that for Australia, being only 12—and is only approached in islands of moderate size; in Sardinia the ratio is the same.

Dr. Heiderich calculated the mean elevation of the island to be 1972—almost

exactly the result of Prof. Marinelli's measurements.—*Memorie della Soc. Geogr. Italiana*, vol. vi. part 2.

AMERICA.

Lake Superior.—Dr. Mark W. Harrington has contributed to the *National Geographic Magazine*, vol. viii. No. 4, a paper on this lake, which, he says, though charted thirty years ago with great accuracy by United States engineers, has not been thoroughly discussed. Mr. R. F. de Grain of the Weather Bureau has made new measurements with a planimeter of its coast-line, and his results give a total of 1872 miles—880 being on the American, and 992 on the Canadian side. Its total area is 32,166 sq. miles, from which 660 should be deducted for islands, the water surface being accordingly 31,506 sq. miles. Whitefish, Nipigon, Black and Thunder bays are sometimes regarded as distinct from the lake, which has therefore an open water surface of 30,465 sq. miles. Of the total 32,166 sq. miles, 23,359 sq. miles are on the American side of the boundary, and 8807 on the Canadian side.

Lake Superior is the largest fresh-water lake in the world, the second being probably Victoria Nyanza, with an area of 25,000 to 30,000 sq. miles. It is a half larger than Lake Michigan (22,000 sq. miles), and forms a third of the combined area of the St. Lawrence lakes, given by Schermerhorn as 95,275 sq. miles. The drainage basin of Lake Superior is comparatively small. Its outline has not been definitely mapped, but the area may be put down as 82,800 sq. miles. Of this 39 per cent. is occupied by the lake itself, and of the land 39 per cent. is Canadian, and 22 per cent. American. The watershed is low on all sides, and in general ill-defined. Near the St. Mary's river it lies but a few score feet above the lake. Westwards it gradually rises to 400 feet fifty miles east of Marquette, and south of Keweenaw point reaches 900 or 1000 feet of relative height. It attains its greatest height, 1500 feet above the lake, in the Mesabi mountains, and isolated points are still higher. On the north side the watershed is more distant, and not as well known. On the south the drainage area is narrow, not more than 20 miles wide, and the streams are numerous but small. The longest on the south shore is the Ontonagon, with a length of 100 miles and a basin of 250 sq. miles.

At the extreme western angle of the lake enters the St. Louis river, considered the source of the St. Lawrence. It is 200 miles long, and drains a basin of 4370 sq. miles. It is separated from the remarkable lacustrine region of Rainy lake by the Mesabi range, while on the west and south the watershed towards the Mississippi is low and ill-defined, and characterised by the presence of lakes, ponds, and swamps. The river rises in the Otter lake, 30 miles from the north-west shore of Lake Superior, and 1650 feet above sea-level, or 1050 above the lake. It descends most of its fall at the rapids at the Dalles, a few miles above Duluth, and contributes on an average 1242 cubic feet of water per second to the lake, according to Greenleaf's estimate, but probably much more. Enterprising engineers have suggested damming up the St. Louis above the Dalles, and bringing the water into Duluth with a head of 650 feet as a cheap source of power. A curious difficulty connected with this scheme is, that if the dam be made too high, the water will flow into the Mississippi and contribute to the water-power of Minneapolis instead of to that of Duluth.

Formerly the lake extended to Fond du Lac, eight miles from Duluth and seven from Superior City. Duluth and Superior City are five miles apart, and this triangle has been filled up by the river within recent geological times. Several times the lake has offered resistance by raising a bar where the current is slackened

on coming into the lake. The bay thus enclosed has been gradually silted up and the process repeated. The fourth bar at Minnesota point is now being filled up. It is five miles long, 200 to 1200 feet wide, and 12 to 15 feet high on an average, but towards the Wisconsin side a pyramid 20 to 25 feet above the water has been built up by the wind. At the Duluth end a canal 300 feet wide was cut to render the interior bays of Duluth accessible, while Superior was approached by the natural outlet of the river. Then Superior had a dyke constructed across Superior bay on the Duluth side of the mouth; but most unexpectedly the river, instead of scouring out the Superior channel, proceeded to fill it up, and the dyke was therefore destroyed.

The north-west coast from the St. Louis to Thunder bay is rocky, extending for about half the distance along the foot of the Sawtooth or Devil's Tracks mountains, and for 200 miles only insignificant streams enter the lake. Into Thunder bay enters the beautiful Kaministiquia, 150 miles long, with a basin of 750 square miles. In its lower course it is a sluggish stream flowing through a broad delta, but higher up it has numerous rapids. Rising in the Lac des Isles and Muskeg lake, it is known as the Dog river as far as the Dog lake.

The Nipigon lake pours its water by the river of the same name into the northernmost point of the lake. It is sometimes stated to be the headwater of the St. Lawrence system, St. Clair and Nipigon lakes being included among the great lakes of the basin, of which Nipigon is the seventh and most distant. It is about 40 miles north of Lake Superior, and lies 850 feet above sea-level. Nipigon river, about 50 miles long, has therefore a fall of 250 feet. The lake is about 60 miles long from north to south, and about 50 broad, with an area of 2900 square miles. The greatest depth hitherto reported is 540 feet, and hence the lake sinks lower than Lake Erie, and down to only 310 feet above sea-level. The erosion at its outlet is very rapid, and the fall is said to be diminishing at the rate of 10 feet a century. The principal feeder is the Ombilika, rising in Summit lake 40 or 50 miles north of Nipigon. Summit lake is said to lie on the watershed, and to send part of its water through the Albany river to James bay.

Of the islands in Lake Superior the largest and most remarkable is the Isle Royale, so named by the early Jesuit missionaries. It consists of a series of ridges running parallel to its length, in some points attaining a height of 400 or 500 feet above the lake. Narrow bays and equally elongated promontories present a complex of land and water, the former steep and rocky, but generally covered with dense woods, the latter deep blue and clear, which is extremely beautiful in bright weather. The water on the island is abundant and the soil excellent. The deep soundings made almost off its banks show that the island is an isolated mountain ridge rising 1000 to 1500 feet from the bottom of the lake.

A series of islands close the three great bays, Thunder, Black, and Nipigon, and the largest of these and next in size to Isle Royale, is St. Ignace. It is of basaltic character, like the others, but the tabular formation so common about Thunder bay is here modified by lower stretches and rounded hills. Its culminating point attains an elevation of about 850 feet.

Currents in the Gulf of St. Lawrence.—Mr. W. B. Dawson's last report, besides various details about stations, tide-gauges, etc., contains an account of his latest investigations in the Gulf of St. Lawrence. The region examined last season was the north-eastern portion between Anticosti and the Strait of Belle Isle. The length of this arm of the Gulf is 220 miles, and its area nearly equal to that of the English Channel. To the south, between the eastern point of Anticosti and Cape St. George in Newfoundland, it has a breadth of 100 miles, while it narrows down

to ten miles at the Strait of Belle Isle, and to sixteen miles at the Mingan Islands on the other side. Around the greater part of the coast the bottom shelves down gradually to eighty fathoms, and along the main arm and on the north side of Anticosti there is a channel 100 to 150 fathoms deep.

This season the currents were of a very different character from those previously observed. In former seasons they were of considerable strength, and maintained the same direction for several hours at a time. Their chief variation was in velocity, which fluctuated with the tide or fell off with the depth (see vol. xi. p. 369). This season, on the contrary, they varied chiefly in direction, veering from hour to hour, and often going all round the compass, and the direction below was often different from that on the surface, while the velocity seldom exceeded one knot per hour. Floats attached by a line to the stern of the *Lansdowne* were, therefore, used, and for the undercurrents a fan consisting of two sheets of galvanised iron fixed at right angles to each other.

While the current in the upper layer down to five or ten fathoms is variable and irregular, the undercurrent at twenty to thirty fathoms frequently exhibits some more definite characteristic, as, for instance, a tendency to make constantly in one direction, or vary with the tide. For the surface-water is more subject to the influence of the wind; while the lower depths are controlled by the general law obtaining in the locality. On the whole, the surface-current when undisturbed by wind seems to set westward, veering, however, with the tide, and sometimes turning all round the compass in about sixteen hours. The tendency to set westwards is shown more distinctly by the undercurrent, which is less influenced by the wind. Off the east end of Anticosti, though it sets north-west when the tide is low, it flows on the whole west-south-west, a fact significant with respect to the general circulation, and also as showing whence the water comes which compensates for the Gaspé current. Off the west coast of Newfoundland the current sets almost always to the north-east, and here only has it been found to have a constant character. The outward current on the west side of Cabot Strait is the most constant that is to be found at any of the Gulf entrances. But the inward current on the Cape Ray side is not so steady. After passing the Strait it probably makes north-eastward, and diffuses itself over the Gulf. Though not yet clearly traced, it would seem that, after spreading over the Gulf, it gradually gains strength, and, passing across the north-eastern part, turns westwards round Anticosti to compensate for the outflow through the Gaspé channel. At Belle Isle the current is usually tidal, with an equal flow in either direction.

Mr. Dawson's report contains a number of tables, and many other observations, on density of the water, etc., which cannot be alluded to here.

The Northern Boundary of Paraguay.—Dr. Hemmerich has been travelling through Paraguay to the south-eastern part of Matto Grosso, and has found the cartography of this region very defective. South of the Rio Apa lies a low plain bounded on the west by wooded hills, 600 or 700 feet high, surmounted by twenty-two summits rising to a height of 1000 feet, while on the east there are some lower elevations. The plain is covered partly with juicy grass, partly with small thickets, and is watered by several streams. The scenery is some of the most beautiful the traveller ever saw. The Rio Apa is also skirted with woods, and is crossed by a ferry. Matto Grosso has a similar surface to that of the northern part of Paraguay, with green meadows and long, well-wooded ranges of hills. The skirts of the high plateaus are healthy, the heat not excessive, and the soil fruitful. The vegetation is consequently luxuriant. Farther north, towards the centre of Goyaz, the country is sandy and desolate. Almost all the details of this country

shown on maps are incorrect, especially the orography.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xl. Nos. 3 and 4.

POLAR REGIONS.

Polar Balloon Expedition.—Dr. Andrée wrote the following telegram before leaving Danes Island, Spitsbergen, on July 11th:—

"In accordance with our decision already announced, we made to-day (Sunday), at 35 minutes past 10 in the morning, preparations for a start, and are now, at half-past 2 in the afternoon, ready to ascend. We shall probably be carried in a north-north-easterly direction, and hope gradually to get into regions with more favourable conditions as regards the wind than exist here. In the name of all my colleagues, I send our warmest greeting to our country and our friends. ANDRÉE."

The balloon, which is named the *Alder* (Eagle), was visible for an hour after the start, and was travelling to the NNE. at a speed of about 22 miles an hour. The Pole is nearly 620 miles from Danes Island, but the journey beyond the Pole, supposing the courageous Swede passes over it, will be longer. The Swedish gunboat, which brought back the news, reports that it experienced a strong south-westerly wind on its voyage to Tromsoe, which it reached on the 16th. If the balloon kept in this current and travelled at 22 miles an hour steadily, the most northerly point should have been passed late on the 12th July, and land might have been reached on the 14th or 15th. But even if the winds continued favourable over this vast region, there are many other difficulties to be overcome. We hope, however, that the balloon has now safely reached a spot whence its adventurous occupants can return to tell their tale.

MISCELLANEOUS.

Rain in Nauru.—In the meteorological observations recorded by District Inspector Jung on Nauru Island (0° 27′ S. lat. and 166° 6′ E. long.), the singularly small rainfall is very striking, compared with the amount registered in the neighbouring Marshall Islands. In 1894 rain to the depth of 25 inches fell on 89 days, whereas in Yaluit 179 inches were measured and 355 rainy days recorded. The rainy season in Nauru usually prevails from October to March, accompanied by westerly winds, but in 1892-93 and 1893-94 it failed to appear, and in 1894-95 set in very late. The marked features of the climate of Nauru are, then, unusual equable temperature, little cloudiness and considerable irregularity in the quantity and frequency of the rain. Storms are rare for a station close to the Equator; of the eight noticed in fourteen months most seemed to pass by the island.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xxiv. No. 3.

Plankton has been before collected by pumping up water through a net, but it has been reserved for the Illinois Biological station to apply the method systematically for quantitative determination. In this way it is possible to measure the exact quantity of water that passes through the net, and also to search for plankton in shallow water, and even among masses of vegetation. The pump is not likely to entirely supersede the older method, for the initial cost is much greater, and it requires two men—one to pump and the other to haul in the hose.

Another innovation introduced at the Havana station is the use of a centrifugal machine to precipitate the plankton. The machine not only saves time, but gives more reliable results, the quantities of plankton obtained by settling often differing by as much as thirty per cent.—*Natural Science*, June.

The trade between India and Turkistan increases year by year. Captain French, Assistant Resident in Leh, states that in the year 1895-96 it amounted to sixty-two lakhs of rupees, while ten years ago it was only twenty-nine lakhs. This progress is to a large extent due to the road which has been constructed from Srinagar to the Chinese frontier, over four passes 16,700 to 18,000 feet high, through barren tracts and over stony river-beds. Many articles that used to be imported into Turkistan from Russia are now obtained from India. Formerly whole caravans were sometimes buried in the snow on the Zoji-la pass, but now the Kashmir Government has erected shelters. The Indian traders meet the Russian and Chinese at Leh for the exchange of wares; some caravans, however, go direct to Turkistan, returning the following year.

In Professor Gerland's *Beiträge zur Geophysik*, Bd. iii. Heft 2, A. Schmidt insists on the necessity for completing a network of magnetic observatories, showing mathematically the errors to which observations are at present liable in consequence of insufficient records; R. Straubel treats of temporary variations of the direction of the plumb-line; and E. Rudolph continues an essay on submarine earthquakes and eruptions. More intelligible to most readers is Dr. Ehrenburg's description of his "Trägheitsbahnglobus," an apparatus he has designed to show the deviation of winds due to the Earth's rotation. A nozzle, movable along the meridian of a globe so that it can be placed at any latitude and capable of being turned to any azimuth, communicates by a pipe through the interior of the globe and one of its poles with an indiarubber ball. The surface of the globe, coloured black, is bestrewn with lycopodium seed, which is disturbed when a puff of air is forced through the nozzle by compressing the indiarubber ball. If, now, the globe be rotated by a handle attached for the purpose, the path is seen to take a curved form. To show the amount of the deviation an arc of a great circle in the direction of the nozzle may be marked in the lycopodium seed by stretching a thread over the surface.

NEW BOOKS.

A History of Ancient Geography. By H. F. Tozer, M.A., F.R.G.S. Cambridge: University Press, 1897.

This volume bears a title which at once prompts the inquiry, What need existed for its production, when Bunbury's work on the same subject is acknowledged on all hands to be a masterpiece that has left nothing to be desired? Our author, as if anticipating that such an inquiry would suggest itself, explains in his preface that the size of that work unfits it for the use of ordinary students, whilst its elaborate details and numerous digressions tend to withdraw attention from the process of development of the story which it tells. He therefore restricts his own narrative to the salient points of inquiry, and having thus been able to compress his materials into a work about one-fourth only of the size of his predecessor's, he has succeeded in giving his readers an uninterrupted view of the continuous progress of geographical science from the Homeric age down to the Augustan, when antiquity reached the furthest limits it was destined to attain of its knowledge of the inhabited world.

This is not Mr. Tozer's first incursion into the domains of Classical Geography. In 1893 he published a volume of *Selections from Strabo*, which he enriched with an introduction and notes that displayed ripe scholarship. There could have been

no better preparative for the composition of the work before us than a study of that author, his *Geography* being by far the most comprehensive treatise on the subject that has been bequeathed to us by the ancients. In tracing the development of the science, Mr. Tozer has followed the method of recording simultaneously, and not in two separate sections, the two kinds of discoveries by which it gradually advanced—those, namely, of a physical and those of a mathematical nature. Much progress had been made by the Greeks, who were the great geographers of antiquity, in acquiring a knowledge of the world that lay beyond their own seas, before they reached any conclusions of worth regarding the shape and size of the earth, and problems of a similar kind. But they were not the first of the civilised nations seated around the more eastern shores of the Mediterranean, who visited countries that lay more or less remote from their own. That distinction belongs to those expert navigators, the Phœnicians of old, whose ships resorted to the most distant trading marts—those on the Mediterranean, the Euxine, and the Erythræan seas, and even those on the ocean itself. The Phœnicians, however, being narrow-minded and selfish in the extreme, and jealous lest others should share with themselves the gains of commerce, kept strictly to themselves all the information of which they became possessed. In this respect they presented a striking contrast to the Greeks, who were ever as ready to impart knowledge to others as their minds were open and quick to receive it. In Homeric times their geographical horizon seems to have been very limited, and it only began to expand in the eighth century B.C., when various Greek states sent out colonies in many different directions. This colonising activity, which persisted through two centuries, was the means of extending their knowledge to eastward along the shores of the Ægean, the Propontis, and the Euxine, and to westward along those of North Africa, Sicily, Italy, Spain, and Gaul. While the shores of Asia which confronted Europe had thus become well known to the Greeks, their information regarding the interior of that continent remained extremely meagre and misty, until a series of events of far-reaching importance gradually dissipated much of the obscurity in which it was shrouded. These were the wars with Darius and Xerxes recorded by Herodotus, the Retreat of the Ten Thousand recorded by Xenophon, and then the conquest of Persia by Alexander the Great, who penetrated to the banks of the Jaxartes and the Sutlej, and the mouths of the Indus. While the great conqueror was thus opening up the eastern world to the knowledge of mankind, Pytheas of Marseilles was engaged in making those memorable voyages which resulted in the discovery of many previously unknown shores and islands washed by the northern seas. After this the Romans were mainly instrumental in promoting the cause of geography, by their campaigns in Armenia and Iberia, by the conquest, in succession, of Spain, Gaul, and Britain, and by the expeditions into Germany and other countries lying to the north of the Alps. The sum of geographical knowledge was also from time to time enlarged by voyages and travels such as those of Hecataeus of Miletus, who, about 520 B.C., wrote the earliest known work on geography—of Scylax, Hanno the Carthaginian, Herodotus, Nearchus, Posidonius, Strabo, and others.

While the knowledge of the inhabited world was thus advancing, mathematical geography, though not neglected, developed but slowly. The earth was at first, in accordance with its appearance to the eye, regarded as a circular plane, surrounded, as some thought, by the ocean stream. In the days of Plato it was discovered that it rotated on its axis, and that it was of a spherical figure was subsequently proved by Aristotle. The measurement of its circumference was next determined, with some approach to accuracy, by Eratosthenes of Cyrene, who from 240 to 196 B.C. held the post of librarian of the Alexandrian Museum. He estimated the great circle of the meridian at 250,000 stadia = 25,000 geographical

miles—an excess of one-seventh. He took as the basis of his calculation the distance between Syene and Alexandria. This he estimated at 5000 stadia, instead of 4000, the actual distance. He erred, besides, in assuming that Syene was under the tropic, and on the same meridian as Alexandria, while in point of fact Syene is thirty-six miles to the north of the tropic, and its meridian considerably to the east of the Alexandrian. He erred further, we may add, in assuming that the earth is a perfect sphere. A later estimate, based on different data from those of Eratosthenes, was made by Posidonius, who flourished about a century before Christ. This erred by defect as that which had preceded by excess. It determined the earth's circumference to be 180,000 stadia, and thus made an equatorial degree comprise 500 stadia instead of 600, its proper length. Eratosthenes, by adding 2000 stadia to his 250,000 for the convenience of computation, made the length of the same degree 700 stadia. The authority of Posidonius stood so high that his estimate was accepted without question, and was that which Ptolemy used in his construction of the map of the world.

The space at our command permits us to advert to one only of the many other topics which Mr. Tozer brings under review. It concerns our own little corner of the world. Such of our readers as have seen Ptolemy's map of Britain must have been struck with the way in which the northern section of the island has been misrepresented, its east coast, instead of being made to run continuously northward, being made to run eastward and face the south. An ingenious suggestion—that of Mr. Henry Bradford—ascribes this distortion not to defective information, but to an error in the construction of the map, and is to this effect: "Either Ptolemy or one of his predecessors had before him three sectional maps representing severally the countries which we call England, Scotland, and Ireland, and drawn approximately to scale, but without meridians or parallels. It was, no doubt, then as now, usual for a map to be enclosed in a rectangular frame, with sides towards the four cardinal points. In fitting the three maps together, Ptolemy (or his predecessor) fell into the mistake of turning the oblong map of Scotland the wrong way. Mr. Bradford further points out, in explanation of the origin of this mistake on Ptolemy's part, that he had assigned to Ireland a latitude so much too high, that if he had given to the map of Scotland its proper orientation, a portion of that country must have fallen right across the western island." In conclusion, we must advert to one or two points regarding which the latest information seems not to have reached Mr. Tozer. He still takes Pattala, which in the days of Alexander the Great was the capital of the Indus delta, and stood where the river at that time bifurcated, to be now represented by Hyderabad. But Major-General Haig, who examined scientifically the geography and hydrography of the delta, and published the results of his survey in 1894, has shown that all the indications forbid the supposition that the Indus ever bifurcated at Hyderabad, and thinks that most likely the old capital of the delta was not far from a spot thirty-five miles south-east from that city. Mr. Tozer, again, in his map of Alexander's Eastern Expedition, has incorrectly traced the line of route by which the great conqueror led his army westward through the sandy wastes of Gedrosia. The line, as traced, leads us to suppose that he kept at a uniform distance from the sea of some sixty or seventy miles. But this was not so, for Colonel Holdich, who has a personal knowledge of Mekran, has shown that Alexander twice reached the coast, first, where the Malan range abuts on the sea, and afterwards near the harbour of Pasni, close to the line of the present telegraph. Our author again does not seem to know the important work by Dr. F. Schwarz of Munich on Alexander's campaigns in Turkistan, a work in which all the places mentioned in the ancient records of these campaigns have been identified by Schwarz himself, who spent fifteen years in the

regions of the Oxus and Jaxartes, and carefully examined their antiquities. Mr. Tozer's work is written in a clear, fluent, and agreeable style, and the maps with which it is illustrated will prove very serviceable to his readers.

Les Voies de Commerce dans la Géographie de Ptolémée. Par M. Vidal de la Blache. Paris: Imprimerie Nationale, 1896. Pp. 132.

The Guide to Geography[1] composed by Ptolemy, the great astronomer of Alexandria, in the latter years of his life, was published about the middle of the second century of our era—a time at which numerous additions had been made to the knowledge of the inhabited parts of the earth. This work, which represents the final stage of development which geographical science was destined to reach in Antiquity, continued to be the paramount authority on the subject until Europe awoke from the long slumber of the Middle Ages. In the paper before us, which was read in November last at a meeting of the Academy of Inscriptions and Belles-Lettres, M. de la Blache, who is sub-director of the *École Normale*, furnishes us with an interesting and instructive commentary on the first book of the Geography, which is of an introductory character, explaining the principles on which scientific geography is based, and stating also the sources from which the author had derived the materials with which he deals. A glance at the contents of the seven books which follow suffices to show that the work was composed more in the interests of cartography than of geography, as exhibited in Strabo's great work on the subject. Each of these books is mainly made up of tables consisting of place-names, followed by the figures of the latitude and the longitude which determine the position of each on the map of the world. The object, then, of our author, in his learned paper, is to examine what aid for the interpretation of these tables can be drawn from a study of the commercial routes which became known to Ptolemy, and were in use in his day. Before he proceeds, however, to examine what the documents were in which these routes were described, and in what manner Ptolemy used them, he has some preliminary observations to offer. Ptolemy's work, he points out, is not to be considered as an isolated performance. Others before him had laboured in the same field, and he had entered into their labours. He had such illustrious predecessors as Eratosthenes, Hipparchus, Posidonius, and Marinus of Tyre, and he had thus at his command the vast mass of materials which these and others had in the course of time accumulated. He was especially indebted to Marinus, his immediate precursor, whom he praises for the diligence with which he had collected his materials, and for the care and judgment which he had shown in sifting them, and he even adopted the system of that geographer as the basis of his own. Marinus had, however, fallen into serious errors. He had, for instance, failed to delineate aright the sphere on a plane surface, and he had, moreover, vastly exaggerated the length of the inhabited world from west to east, as well as its breadth from north to south. For the correction of these excessive estimates, Ptolemy availed himself of certain documents which described the great trade-routes by which two important articles of commerce, ivory and silk, were conveyed to the Græco-Roman marts from the far remote regions in which they were produced. The knowledge of the routes for silk was found in a memoir composed by a Syrian merchant—Maës, the Macedonian—who had not himself visited the Seres, but gave his account of the way to their metropolis from the reports of his agents employed in the silk traffic. The routes through India for the same commodity, our author thinks, became known to Ptolemy from the *Periplus of the Erythræan Sea*, a work which belonged to the age of Pliny. Ivory, again,

[1] Γεωγραφικὴ ὑφήγησις—*lit.* A Geographical Guide.

may have been brought from Agisymba, a country in Ethiopia, and transported to the Mediterranean by the route described in the reports of the Roman commanders, Septimius Flaccus and Julius Maternus, who, starting, the one from Fezzan, and the other from Leptis Magna, had, in the course of a four months' journey, penetrated far southwards into the heart of Africa. For the details concerning these routes, and Ptolemy's method of dealing with the distances recorded, we must refer our readers to the work under notice, which is accompanied by three sketch-maps, which contribute materially to the better understanding of the text. We must remark, in conclusion, that Ptolemy's reduction of the overestimates of Marinus was very far from being sufficient, and that he besides fell into the great error of adopting from Posidonius five hundred instead of six hundred stadia as the length of a degree at the Equator.

A History of Newfoundland from the English Colonial and Foreign Records. By D. W. Prowse, Q.C., LL.D., etc. 2nd Edition. London: Eyre and Spottiswoode, 1896. Pp. x + 634.

It speaks well for the popularity of Dr. Prowse's History of Newfoundland, that he has found it necessary to issue a second and cheaper edition within a couple of years. The new edition is somewhat less in size than its predecessor, and contains a verbatim reproduction of the history of the colony, as given in the first edition, down to the year 1894. The concluding chapter describes the present position and prospects of the colony, and indicates that its prosperity is practically contingent on its joining a federation of all the British North American colonies. If this is true, then the prospects of the colony cannot for the present, at any rate, be considered rosy, as its past history for the last half century and more, looked at from any point we may, does not commend it as a desirable confederate state, or one which solvent, peaceful, and law-abiding colonies would be eager to welcome into an indissoluble partnership. Still, the discoveries of good coal and iron point to better days in store for Newfoundland, and a future in which it will not be dependent solely on its fishings.

In its present condition, Newfoundland, according to Dr. Prowse, who is a true patriot, and by no means despairs of his country, is not a colony which offers many attractions to the emigrant seeking for a new home, unless he is a fisherman. The soil is mostly poor, and not well suited for the cultivation of wheat, but barley and oats thrive well. "The greatest drawback to our climate," says Dr. Prowse, "is the tardy and uncertain spring. The summer is always delightful, and, except in the extreme north of the island, there is generally no severe weather before Christmas. During the winter, the cold is much less severe than in Canada." A large part of the colony is rocky and barren. More fertile land may exist, but it is known only to the surveyor and lumberer. To the agriculturalist, then, there are but few attractions, but the prospects of the sportsman seem a little better. There are large herds of Cariboo reindeer within a reasonable distance of the railway and the shore, at certain seasons of the year; but the game laws prohibit the sportsman from shooting more than four stags and three does, and for this he must take out a licence, costing one hundred dollars. Willow grouse, ptarmigan, and wild fowl are said to be fairly plentiful. Salmon and trout fishing are particularly good. One instance is given, in which an angler killed thirty salmon and grilse, to his own rod, in one day. The close-time both for fish and game is unusually long.

The real wealth of the Newfoundland of to-day still consists in its sea fisheries, which, if the mistakes of the past are avoided, should ensure continued prosperity

to the colony. The markets for Newfoundland fish are practically unlimited, including, among other places, the United Kingdom, France, Spain, Canada, and the United States. But the trade in fresh fish must be commenced and developed just as the trade in fresh meat and fruit has elsewhere been commenced and developed. To secure prosperity, however, the inhabitants must set their house in order, and live at peace with each other, and this change cannot be accomplished in a day. The virulence of political animosity must cease; commerce must be conducted on sound and honest financial principles; the press must be purified; and the whole social tone and atmosphere of the community must be ameliorated. Then, and not till then, will Newfoundland be able to take its place as one of the most prosperous and enlightened, as it is one of the oldest, colonies of the empire.

Most of the plates which illustrated the first edition have been omitted from the second, and there is no index—a very serious omission in a historical work bristling with details.

The First Crossing of Spitsbergen. By Sir William M. Conway. London: J. M. Dent and Co., 1897. Pp. 371. *Price* 30*s.*

This handsome volume is illustrated with eight coloured plates, two maps, and about one hundred full-page and text illustrations from photographs and sketches. Sir William Conway's spelling of Spitzbergen will at once arrest attention. He says it should be spelt "Spitsbergen," because "the name is Dutch." We are afraid, however, the English and German "Spitzbergen" will prevail.[1] It may be quite true that Dutchmen discovered Spitzbergen in 1596 when "sailing northwards to find a way over the Pole from Holland to China," but only nine years later "the same coast was revisited, and further explored by the English navigator Hudson," sailing with a similar purpose; and it was the English, not the Dutch, who discovered and established the whale fishery of Spitzbergen, of which they claimed the monopoly until it was resisted by the Dutch, who consented to divide the territory with them.

The interesting journey related in this volume took place in the summer of 1896: Sir William Conway's party, aided by a handsome subsidy from the Royal Geographical Society, successfully crossing Spitzbergen from Advent Bay to Klok Bay, thence to Sassen Bay, thence to Agardh Bay on the east coast, and back to Advent Bay. They made thirteen mountain ascents, and brought home "a sketch survey of an area of about 600 square miles in the heart of the interesting middle belt of the country, besides a more rapid outline survey of the hills on either side of Wijde Bay."

Sir William Conway has a chapter on Spitzbergen as a summer resort, and tells how from 1891 onwards Captain Bade, and other enterprising German caterers for the public entertainment, proved "that tourist steamers to Spitsbergen would pay." In 1893 the Hamburg-American Company's great steamer *Columbia* brought a cargo of visitors to Advent Bay. In 1894 the Orient steamer *Lusitania* followed her example, and others have succeeded. Finally in 1896, "Spitsbergen may be said to have been formally annexed by the ubiquitous tripper," for a Norwegian Company began a weekly summer service of steamers from Hammerfest to Advent Bay, and established a small inn on Advent Point. Those of our members who intend visiting Spitzbergen may like to know that its "temperature on fine, clear, still days is like that of a warm English spring, but such days are not, of course, a majority. Usually the weather is cold, and warm clothing is a necessity, especially on board ship." The most interesting

[1] As, however, *Spitsbergen* is the correct spelling, it will be used in this Magazine.—Ed.

part of Spitzbergen for a rapid view is the west coast and bays north of it, where grand rocks and glaciers are found ; the author considering "an expedition to the north-west corner of the island an essential part of any well-conceived visit to Spitsbergen, however brief."

The Heroes of the Arctic and their Adventures. By FREDERICK WHYMPER. 9th Edition. London : Society for promoting Christian Knowledge, 1897. Pp. 391.

The author, who is the brother of Edward Whymper, author of *Scrambles in the Alps*, states in his preface that public interest in Arctic exploration has recently been revived by the grand exploits of Dr. Nansen, and by the efforts of the Harmsworth-Jackson expedition, and "of Dr. Peary of aeronautic fame." There is some mistake here. Mr. Whymper seems to have confused the would-be aeronautic explorer Andrée with the celebrated and successful explorer Peary. It must be hard upon the young or slightly informed people, for whom this manual is intended, when the author himself is so confused. Besides, he does not tell them anything more about Peary, beyond imparting the erroneous information that he was an aeronaut. This is unjust to Peary, who deservedly ranks as one of the foremost of modern Arctic explorers. Altogether, we cannot agree with the statement on this little book's title-page, that it has been "brought to date."

Zum ewigen Eis. Eine Sommer Fahrt ins nördliche Polarmeer und Begegnung mit Andrée und Nansen. Von GEORG WEGENER. 2te Auflage. Berlin : Allgemeines Verein für Deutsche Litteratur, 1897. Pp. 359. *Price 6 M.*

Dr. Wegener had the good fortune to meet the aeronaut Andrée in Spitsbergen, and the explorer Nansen on his return to Hammerfest in Norway. He describes Andrée's appearance with enthusiasm. "Tall, broad, powerful, he stood there before me in his pilot-jacket and enormous sea-boots, with sharply curved nose and clearly cut features, whilst a fair moustache covered his lips. His clever eyes were surrounded by little wrinkles, and streamed not merely with power of will but good-heartedness and good humour, and with a genial assurance which I expected from all I had ever heard or read of him." On a later occasion Dr. Wegener asked Andrée why he gave up the ascent last year. Andrée replied, "For the simple reason that the winds would not have permitted my reaching my goal," adding : "Only winds blowing from the south or a southerly direction, and of tolerably high velocity, would be of use to me." Excellent illustrations and two maps embellish this book *To the Everlasting Ice.* According to a map, the projected course of Andrée's balloon is from Skjaervö in Norway, along the west coast of Spitsbergen, right across the North Pole, and then proceeding to the south of the New Siberian Islands and landing in Siberia—perhaps the most venturesome expedition yet attempted by man.

Der Südpol. Die Südpolarforschung und die deutsche Südpolar-Expedition. Von Dr. GEORG WEGENER. Berlin : Hermann Paetel, 1897. Pp. 66. *Price 1 M. 50.*

At a meeting of the German Geographical Congress held at Bremen in 1895, an Antarctic expedition was resolved upon, and this pamphlet is written to encourage and explain the enterprise. A map gives the route of the projected expedition. Starting from the Cape of Good Hope, the German expedition proposes to sail to Kerguelen Island, whence a détour to the west will be made to near Kemp Island, where winter quarters will be established, after which the

expedition will push south-west to the Magnetic South Pole. The admirable *Süd-Polar Karte* by A. Petermann (from Stieler's *Hand Atlas*) and a bibliography of the Antarctic regions, are appended. The German South Pole Commission estimate the cost of the expedition at 950,000 marks, or about £47,500, and has appealed to the German nation for voluntary subscriptions.

Sketches Awheel in fin de Siècle Iberia. By Fanny Bullock Workman and William Hunter Workman, M.A., M.D. London: T. Fisher Unwin, 1897. Pp. xxiv + 228. *Price* 6*s.*

This is in the first instance a cyclist's book. There is much information about roads, the difficulties and even dangers a cyclist is likely to encounter, and the special opportunities he may enjoy of seeing places and visiting people which any one but himself and a pedestrian would be sure to miss. We cannot attempt to epitomise it here. The traveller who may think of following Dr. and Mrs. Workman on wheels must buy the book. The route was a most comprehensive one, taking them from the north-eastern corner of the country through the eastern provinces to Murcia, across by Granada, Malaga, and Seville to Cadiz, with an extra trip to Tangier and Tetuan, and then north by Madrid and Burgos to the frontier.

But the volume has an interest for a very much wider circle of readers. It abounds in graphic sketches of Spanish scenery, cities, and life. The author has the gift of artistic insight, and the power of picturesque description. In proof of this we need only refer to his pictures of Montserrat, and of the road from Elche to Murcia, the scenery of the latter making him exclaim, "Why is this lovely corner of the world so little known?" and to his discriminating contrast between the quiet grace of the Alhambra and the gaudy decorations of the Alcazar of Seville. Spain is a country of contrasts, and Dr. Workman brings them into vivid relief—the bare table-lands cut by deep watered ravines with their luxuriant vegetation, the lofty sierras and rich valleys, old Moorish palaces and Christian cathedrals, the chivalry and hospitality of many of the people and the rudeness and passionate savagery of others, the pomp of religious ceremony and procession, and the bustle and garishness of country fairs.

We have only one complaint to make. The pages are freely sprinkled with Spanish words, and it must be irritating to a reader whose knowledge of the language is imperfect, and who has no dictionary at hand, to think that he is now and again missing some delicate shade of meaning which would much enhance his appreciation of the description. A list of words with, as far as possible, their English equivalents would obviate this difficulty. An excellent route-map opens to face the reader as he finds his way through the book.

Die Balearen in Wort und Bild. Würzburg: Leo Woerl, 1897. 2 vols.

The illustrious author of the grand work on the Lipari Islands has now pushed his island-studies farther west, and presented us with these two splendid volumes on the Balearic Islands. It would be difficult to do adequate justice to their contents whether as regards minute observation, faithful description, or abundant and artistic illustration. Suffice to say that the little-known and out-of-the-way Balearics have been treated in a princely manner by a princely hand, and that no one desiring to visit or to study them ought to do so without conning the pages of these attractive volumes.

In Court and Kampong, being Tales and Sketches of Native Life in the Malay Peninsula. By Hugh Clifford. London: Grant Richards, 1897. Pp. ix +156. *Price 7s. 6d. net.*

In publishing this collection of "tales and sketches of native life in the Malay Peninsula" the British resident of Pahang must have been animated by the same desire as the fat boy in Pickwick, when he told Mrs. Wardle, "I wants to make yer flesh creep." For your Malay, according to Mr. Clifford, is a monster in comparison with whom the unspeakable Turk is an apostle of culture and an angel of light. "The Pahang Malay, in his unregenerate state, thinks chiefly of deeds of arms, illicit love intrigues, and the sports which his religion holds to be sinful. He is a cockfighter, a gambler, and a brawler; he has an overweening opinion of himself, his country, and his race; he is at once ignorant, irreligious, and unintellectual, and his arrogance has passed into a proverb." *Per contra*, he is manly and reckless, dresses well, a sportsman, loyal to his chief, loves his family, clean in his habits, cheery and enjoys a joke at other people's expense, hates books and work, and says his prayers at the mosque on Friday, but only to avoid a fine. The Malays of Trengganu are peaceful students and traders, but accomplished liars and cowards. Those of Kelantan are good-tempered and brave, but with less self-respect, and they are professional thieves and robbers.

To the sportsman the country offers attractions of every description, tempered by a very trying climate and the absence of good roads and means of communication, except by water. There is a considerable trade in silks, white cloth for turbans, weapons, and fish.

The stories, which are exceedingly well told by Mr. Clifford, illustrate chiefly the dark side of the Malay character, and indicate that the peninsula, which has been under British influence for about quarter of a century, is still one of the dark places of the earth, and an excellent field for the philanthropist and the missionary.

The North-Western Provinces of India. By W. Crooke, Bengal Civil Service. London: Methuen and Co., 1897. Pp. x+361. *Price 10s. 6d.*

Of late years the public have received from retired members of the Bengal Civil Service various novels and tales as their contribution to literature, but in this volume on the North-western Provinces of India, Mr. Crooke has risen to a much higher level and has brought before his readers a succinct and intensely interesting account of their history, ethnology, and administration. He writes with the strong and ready pen of a master of his subject, and his style is easy and graceful. Although often dealing with technical matters which are beyond the range of ordinary readers, he is never obscure or pedantic; on the other hand, he repeatedly rises to passages of powerful eloquence. He has a keen eye for the beauties and terrors of Nature, and sets them before his readers in glowing and fascinating language. Nor is he deficient in a sense of humour, although the nature of his subject gives him but little scope for its exercise.

The North-western Provinces in 1857 included the district of Delhi, and must ever be interesting to us as the scene of much the most important part of that tragic drama which is still called "*the* Mutiny." It is here also that the brunt of the present famine has fallen, and some remarks of Mr. Crooke on the subject of famine may be quoted. "The expense of meeting an emergency of this kind is a serious financial difficulty; but economy is secured by the enforcement of the principle that famine relief is a provincial not an imperial charge. And it must be remembered that the annual charge for poor relief in England and Wales is nearly ten millions per annum, from which, so far, India has escaped

Nowhere has the practice of charity been more generally raised to the level of a religious duty. Much of it, it is true, such as the food and gifts lavished on Brahmans and religious mendicants, is sheer waste; much of the marriage alms and daily doles distributed to all comers by rich traders are merely a form of ostentation, and do harm by pampering the recipients. On the other hand, there is a vast amount of quiet simple benevolence in rural life. The widow is ever bringing her gift to the treasury, and the very poor can always find a handful of grain for the destitute. With a large indigent population, the temptation to start some form of permanent relief is largely felt; but the risk of pauperisation is fully recognised, and it is very doubtful if sufficient voluntary contributions could be secured. All native benevolence takes the personal form, and regular subscriptions to permanent charities like hospitals are not readily given. In any general scheme of relief, the burden thus undertaken would ultimately fall on the State, which has no sufficient funds to meet it."

No one can read many pages of this book without noticing the earnest sympathy which the writer has for the natives of India—how well he appreciates their good and strong points, and how plainly he perceives and admits the weak points and failures in administration. His previous work on the Folklore of Upper India showed him to have an intimate knowledge of the religious traditions, legends, domestic life, habits, and customs of the people, which is probably unrivalled. In this present work he has shown himself a master of their history and ethnology; and his description of the administration of the provinces, condensed as it necessarily is, will amply suffice to show the attentive reader many of the difficulties attending the multiform duties which have to be faced day by day by the handful of officers who govern the country. This book contains the matured opinions of one who, to a sincere, profound, and enlightened sympathy for, and knowledge of, the people, added personal energy, capacity, and attainments of a very high order, for the exercise of which he, happily for the Government and the people, had plenty scope. It will be received at once as a masterly exposition of the various matters with which it deals—all the more so as it is practically up to date.

The Queen, Her Empire and the English-speaking World. London: Society for Promoting Christian Knowledge, 1897. Pp. viii + 136. *Price* 5*s*.

This is a collection of over one hundred and thirty photographs of towns, country, railways, etc., in the British Empire and the United States, most of them very well reproduced. It is issued on the occasion of the Diamond Jubilee. A short paragraph of explanatory letterpress accompanies each view. It would be an improvement if the views were arranged in geographical order. Also, it is to be hoped that the omission of the first two photographs in the copy before us is not repeated in others.

Die Handelswege und Verkehrsmittel der Gegenwart, unter Berücksichtigung früherer Verhältnisse. Von Dr. M. Schmitz, Oberrealschul-Oberlehrer. Breslau: Ferdinand Hirt, 1897. Pp. 87. *Price M.* 1.50.

After a short introduction on the history of the development of means of communication, the author gives details of the principal lines of steamships and the great continental railways, telegraphs, etc. The information is voluminous and on the whole accurate, though there are a few omissions and inaccuracies, which might be expected amid such a mass of facts. For instance, the Canadian Pacific railway crosses over the Kicking Horse, *not* the Yellowhead Pass, and

the project of a line from Vladikavkas to Tiflis has been abandoned in favour of the Baku and Petrovsk route. The Castle Line to the Cape is not mentioned, unless under the title of "Colonial Mail Line," and in other parts of the book the author seems to be not very well acquainted with our steamship lines. Surely, also, the telegraph line from the Cape to Blantyre deserves a place, at any rate, on the map. A more serious error is to speak of a telegraph from Yokohama to Vancouver.

The book is primarily intended for use in schools, and no doubt is compiled with regard to the German school regulations. To us it seems too similar to our old text books, a collection of facts more suitable for reference.

Longmans' Geographical Series. Book I.—*The Child's First Book of Geography.* II. and III.—*The World.* IV.—*The British Empire.* V.—*A Primary Physical Geography.* London: Longmans, Green, and Co., 1896.

In spite of the multitude of geographical school-books Longmans' Geographical Series will, we doubt not, commend itself to teachers and pupils. The books are fully supplied with relief and coloured maps so that no atlas is required, and they provide in an attractive form, and without burdening the memory with useless facts and figures, an amount of information which is well suited to the needs of the pupils at the successive stages of their geographical studies. The physical characteristics of each country are clearly brought out, while the remarks on its commercial features are particularly full and to the point. Book V., which is an elementary Physical Geography, will be welcome to students on account of the useful glossary at the end giving a concise summary of physical geography under alphabetically arranged catch-words. Needless to say that the books are well printed and strongly bound. But before this series can be pronounced perfect, several inaccuracies must be corrected. On the political map of South Africa we notice Biera instead of Beira. Why does the text (III. p. 367) print Tokiyo, Kiyoto, while the map has Tokio, Kioto? On the same map we find Nagaya instead of Nagoya. Port Arthur, of which one hears so much now, does not seem to be indicated. We have also searched the maps in vain for the Sandwich Islands and Samoa. With regard to Samoa, the pupil studying the British possessions in Book IV. can hardly help believing this to be a British island. In Book V. p. 103 we find the Aryans or Indo-Europeans divided into Hindus, Teutons, Kelts, and Slavs of Hungary. What about the Russians, Italians, Greeks, and other Europeans?

A Text-book of Geology. By W. J. Harrison, F.G.S. 4th edition. London: Blackie and Son, 1897. Pp. 343. *Price* 3*s.* 6*d.*

A text-book which has reached its fourth edition may be supposed to serve its purpose. It appears to be intended primarily for students who are preparing for the examinations by the Science and Art Department, and is in consequence something of a cram-book. If the student commits to memory the author's various statements and definitions he will doubtless be able to answer the questions set by the Science and Art Department, specimens of which are given in an Appendix. But we cannot recommend the book to those who have no such examinations to face. The information it contains is much too crowded and condensed, and the author, in his attempt to squeeze everything into a narrow space, has not always succeeded in being either clear or correct. The beginner who wishes to obtain a good grasp of the subject would be wise to select a simpler and less ambitious introduction to the science.

NEW MAPS.

AFRICA.

TRIPOLI. A map of Parts of Gharian, Tarhuna, and M'salata. By H. Swainson Cowper, F.S.A. *The Geographical Journal, June.*

VICTORIA NYANZA, Das Südufer des ——. Von Pater Brard. Massstab 1 : 750,000. *Petermann's Mitteilungen, Taf.* 7, 1897.

AMERICA.

UNITED STATES, Geological Survey of the ——. Charles D. Walcott, Director.

General Maps. Scale 1 : 62,500.

California : Las Bolsas, Pasadena, Redondo, San Mateo, San Pedro, Santa Ana, Santa Monica.

New York—Vermont : Ticonderoga.

Pennsylvania : Norristown.

Pennsylvania—Delaware—New Jersey : Chester.

Pennsylvania—New Jersey : Philadelphia.

Scale 1 : 125,000.

Colorado : Pueblo.

Georgia : Monroe.

Kansas : Ashland, Garden, Hays, Osborne, Plainville, Russell.

Mass.—Conn. : Holyoke.

Nebraska : Lexington, Stromsburg.

Nebraska—Kansas : Arapahoe, Holdrege.

North Dakota : Edgeley, Jamestown.

South Dakota : Harney Peak.

South Dakota—Nebraska : Oelrichs.

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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION.

By J. Scott Keltie, LL.D., Sec. R.G.S.,

President of the Section.

We meet this year in exceptional circumstances. Thirteen years ago the British Association met for the first time in a portion of the Empire beyond the limits of the British Islands. During these thirteen years much has happened of the greatest interest to geographers, and if I attempted to review the progress which has been made during these years—progress in the exploration of the globe, progress in geographical research, progress in geographical education—I could not hope to do it to any purpose in the short time during which it would be right for a president to monopolise the attention of the Section. But we have, at the same time, reached another stage in our history which naturally leads us to take stock of our progress in the past. We have all of us been celebrating the sixtieth year of the glorious reign of the Sovereign, of whose vast dominions Canada and the United Kingdom form integral parts. The progress made during that period in our own department of science has been immense; it would take volumes to tell what has been done for the exploration of the globe. The great continent of Africa has practically been discovered, for sixty years ago almost all but its rim was a blank. In 1837 enormous areas in North America were unexplored, and much of the interior of South America was unknown. In all parts of Asia vast additions have been made to our knowledge; the maps of the interior of that continent were, sixty years ago, of the most diagrammatic character. The Australian interior was nearly as great a blank as that of Africa: New Zealand had not even been annexed. Need I remind

you of the great progress which has been made during the period both in the North and South Polar areas, culminating in the magnificent achievement of Dr. Nansen? It was just sixty years ago that the great Antarctic expedition under Sir James Ross was being organised; since that, alas, little or nothing has been done to follow up his work. Sixty years ago the science of Oceanography, even the term, did not exist; it is the creation of the Victorian era, and may be said almost to have had its origin in the voyage of the *Challenger*, which added a new domain to our science and opened up inexhaustible fields of research. I have thought then that the most useful and most manageable thing to do on the present occasion will be to indicate briefly what, in my estimation, are some of the problems which geography has to attack in the future, only taking such glances at the past as will enable us to do this intelligibly.

It has been customary for the occupants of this chair to try to define the field of geography, and on occasions, in somewhat too apologetic language, to justify its existence as a section of a scientific association. I do not think this is any longer necessary. Even in England and America, during the last thirteen years, geography has done work enough to prove that she has a mission which no other department of research can fulfil. I say thirteen years, because that not only carries us back to the last Canadian meeting of the British Association, but to the year when the Royal Geographical Society undertook an inquiry into the position of geography at home and abroad, mainly with a view to the improvement of geographical education in England. During that time a good deal has been written as to the field and scope of geography, and a good many definitions given. But we really did not require to go to Germany to teach us as to the field and functions of geography. Sixty years ago, the then President of the Royal Geographical Society, Mr. William R. Hamilton, delivered the first presidential address ever given at that Society, and his conception of the field and aims of geography was as exalted and comprehensive as the most exacting German geographer could wish. It is too long to quote here.[1]

It would be difficult to improve on Mr. Hamilton's definition, and it shows that a correct conception of the wide and important field of geography is no new thing in England. He proceeded to indicate what remained to be done in the field of exploration, and I commend his address to any one desirous of forming a conception of the vast progress that has been made since it was delivered, sixty years ago. Since I am dealing with definitions, I may be permitted to quote that given by one so severely scientific as General Sir R. Strachey in a course of lectures which he gave at the University of Cambridge in 1888, in connection with the establishment of a lectureship in Geography in that University. "The aim of geographical science," he says, "is to investigate and delineate the various features of the earth; to study the distribution of land and sea, the configuration and relief of the surface, position on the globe, and so forth, facts which determine the existing condition of

[1] *Journal R.G.S.*, vol. viii. 1838.

various parts of the earth, or which indicate former conditions; and to ascertain the relations that exist between these features and all that is observed on the earth. . . . I claim for geography," Sir R. Strachey says, "a place among the natural sciences as supplying the needful medium through which to obtain a connected and consistent conception of the earth and what is on it." He gives a list of the various matters which, in his conception, it is the business of geography to deal with, and they are varied and important enough to satisfy the demands of the most exacting. "These are," he says, "the studies through which scientific geography will lead you, teaching you to view the earth in its entirety, bringing together the great variety of objects seen upon it, investigating their connection, and exploring their causes; and so combining and harmonising the lessons of all the sciences which supply the key to the secrets of Nature." [1]

I think we may briefly define geography as the science of the topographical distribution of the great features of the earth's surface and of all that it sustains—mineral, vegetable, and animal, including man himself. In fact, man is the ultimate term in the geographical problem, the final object of which is to investigate the correlation between humanity and its geographical environment.

I may be pardoned for dwelling at some length on the function and field of geography. It is a subject that has been occupying the attention of geographers in England for some years, and it may not be without interest to our colleagues on this side of the Atlantic to know the conclusions which we have come to. Moreover, it seems necessary to arrive at some clear conception on the matter, with a view to the researches of the future. I say that the subject has been occupying our attention in England for some time; it has done so, I may say, as a result of the inquiry by myself on the part of the Royal Geographical Society, to which I have referred. The object of that inquiry was mainly to collect information as to the position of geography in education at home and abroad. The report which I presented to the Society attracted some attention, and whether as a result of that or not it is hardly for me to say, but certainly since that inquiry some twelve years ago, the position of geography in England has considerably improved both in education and as a field for research. Better methods have been introduced in our schools; a much wider scope has been given to the subject; in many quarters teachers have shown themselves anxious to be guided in the right direction; and, above all, both Oxford and Cambridge at length consented to the establishment of lectureships in geography. A school of young geographers has grown up, consisting of men who have had a thorough university training in science and letters, and who are devoting themselves to the various branches of geography as a speciality. In this way the arid old text-books and characterless maps are being supplanted by others that will bear comparison with the best productions of Germany. Photography and lantern slides illustrating special geographical features are coming into use in schools; and in other

[1] *Lectures on Geography delivered before the University of Cambridge.* London, 1888.

directions appliances for use in education are being multiplied and improved. A British geographical literature is growing up, and if, as I hope, the progress be maintained, we shall be able to hold our own in geography with any country. The interest in the subject has been extended by the foundation of geographical societies in various large centres; whereas thirteen years ago the only geographical society was that of London, there are now similar societies in Manchester, Newcastle, Liverpool, and Edinburgh, the last with branches in Glasgow, Dundee, and Aberdeen. If this progressive movement is maintained, as there is every reason to hope it will be, the scientific and educational aspects of geography in Britain will be more nearly on a par with exploration in which our country has so long held the lead.

In the United States I found that the position of the subject in education was not much more satisfactory than it was in England. Since then there is reason to believe considerable progress has been made. One of the best text-books on physical geography, Hinman's *Eclectic Physical Geography*, is of American origin; while in the States, as in England, a school of scientific geographers has arisen which bids fair to give the subject a high place in that country. I fear, from what I can learn, that the position in Canada is not as satisfactory as it ought to be. It seems to me, then, that one of the great problems which geographers have to face in the future is the place which this subject is to hold in education, both as a body of information and as a discipline. We have been making progress, and if we persevere with intelligence and firmness, and maintain the subject at the highest standard as a field of research, there can be little doubt of our success.

There is a prevalent belief that geographers have nothing more to learn in Europe, that that old continent has been thoroughly explored. It is true that nearly every country in Europe has been, or is being, trigonometrically surveyed. Except some parts of the Balkan Peninsula and North of Russia, the topography of the Continent has been accurately mapped on scales and by methods sufficient at least for the purposes of the geographer. Yet there are districts in the Balkan Peninsula—for example, Albania—which are as vaguely known as Central Africa. But it is a delusion to think that because a country has been fully mapped the occupation of the geographer is gone. It is only when a region at large is adequately mapped that the work of geographical research begins. The student, with a satisfactory map of a definite district as his guide, will find on the spot abundant occupation in working out its geographical details, the changes which have taken place in its topography, and the bearing of its varied features upon its history, its inhabitants, its industries. This kind of work has been in progress in Germany for over ten years, under the auspices of the Central Commission for the Scientific Geography (Landeskunde) of Germany, with its seat at Stuttgart. Under the collective title of "Forschungen zur Deutschen Landes- und Volkskunde," a long series of monographs by specialists has been published, dealing in minute detail with one or more aspects of a limited district. Thus we have such memoirs as *The Plain of the Upper Rhine and its Neighbouring Mountains*, by Dr. Richard

Lepsius; *The Towns of the North German Plain in relation to the Configuration of the Ground*, by Dr. Hahn; *The Munich Basin: a Contribution to the Physical Geography of Southern Bavaria*, by C. Gruber; *The Mecklenburg Ridges and their Relation to the Ice Age*, by Dr. E. Geinitz; *The Influence of the Mountains on the Climate of Central Germany*, by R. Assmann; *The Distribution and Origin of the Germans in Silesia*, by Dr. K. Weinhold; *Mountain Structure and Surface Configuration of Saxon Switzerland*, by Dr. A. Hettner; *The Erzgebirge: an Orometric-Anthropogeographical Study*, by Dr. J. Burgkhardt; *The Thuringian Forest and its Surroundings*, by Dr. H. Pröscholdt, and so forth. There is thus an inexhaustible field for scientific geography in its most comprehensive sense, a series of problems which may take generations to work out. In a less systematic way we have similar monographs by French geographers. One or two attempts, mainly by teachers, have been made in England to do similar work, but the impression generally produced is that the authors have not been well equipped for the task. I am glad to say that in England the Royal Geographical Society has initiated a movement for working out in a systematic fashion what one may call the regional geography of the British Islands on the basis of the one-inch maps of the Ordnance Survey. It is a strange thing that the geography of the Mother Country has never yet been systematically worked out.

Taking the sheets of the Ordnance Survey map as a basis, it is proposed that each district should be thoroughly investigated, and a complete memoir of moderate dimensions systematically compiled to accompany the sheet, in the same way that each sheet of the Geological Survey Map has its printed text. It is a stupendous undertaking that would involve many years' work, and the results of which when complete would fill many volumes. But it is worth doing; it would furnish the material for an exact and trustworthy account of the geography of Britain on any scale, and would be invaluable to the historian, as well as to others dealing with subjects having any relation to the past and present geography of the land. The librarian of the Society, Dr. H. R. Mill, has begun operations on a limited area in Sussex. When he has completed this initial memoir, it will be for the Society to decide whether it can continue the enterprise, or whether it will succeed in persuading the Government to take the matter up. I refer to work of this kind mainly to indicate what, in my conception, are some of the problems of the future which geography has to face, even in fully surveyed countries. Even were the enterprise referred to carried out, there would be room enough for special researches in particular districts.

But while there is an inexhaustible field in the future for geographical work in the direction I have indicated, there is no doubt that much still remains to be done in the way of exploring the unknown, or little known, regions of the globe. Let us briefly refer to the problems remaining to be solved in this direction. Turning to the continent of Asia, we find that immense progress has been made during the past sixty years. In the presidential address given sixty years ago, already referred to, Mr. Hamilton says of Asia:—"We have only a very general knowledge of the geographical character of the Burman, Chinese, and Japan empires;

the innumerable islands of the latter are still, except occasionally, inaccessible to European navigators. Geographers hardly venture on the most loose description of Tibet, Mongolia, or Chinese Tartary, Siam, and Cochin China." Since then the survey of India, one of the greatest enterprises undertaken by any State, has been completed, and is being rapidly extended over Burma. But I need not remind you in detail of the vast changes that have taken place in Asia during these years, and the immense additions that have been made to our knowledge of its geography. Exploring activity in Asia is not likely to cease, though it is not to be expected that its inhospitable centre will ever be so carefully mapped as have been the mountains of Switzerland.

The most important desiderata, so far as pioneer exploration in Asia is concerned, may be said to be confined to two regions.[1] In Southern and Central Arabia there are tracts which are entirely unexplored. It is probable that this unexplored region is in the main a sandy desert. At the same time it is, in the south at least, fringed by a border of mountains whose slopes are capable of rich cultivation, and whose summits the late Mr. Theodore Bent found, on his last and fatal journey, to be covered with snow. In exploration, as in other directions, it is the unexpected that happens; and if any traveller cared to face the difficulties—physical, political, and religious—which might be met with in Southern and Central Arabia, he might be able to tell the world a surprising story.

The other region in Asia where real pioneer work still remains to be done is Tibet and the mountainous districts bordering it on the north and east. Lines of exploration have in recent years been run across Tibet by Russian explorers like Prejevalsky, by Rockhill, Prince Henry of Orleans, and Bonvalot, by Bower, Littledale, Wellby, and Malcolm. From the results obtained by these explorers we have formed a fair idea of this, the most extensive, the highest, and the most inhospitable plateau in the world. A few more lines run in well-selected directions would probably supply geography with nearly all she wants to learn about such a region, though more minute exploration would probably furnish interesting details as to its geological history.

The region lying to the north of the Himalayan range and to the south of the parallel of Lhasa is almost a blank on the map, and there is ample room here for the enterprising pioneer. The forbidden city of Lhasa is at present the goal of several adventurers, though as a matter of fact we cannot have much to learn in addition to what has been revealed in the interesting narrative of the native Indian traveller, Chandra Das. The magnificent mountain region on the north and east of Tibet furnishes a splendid field for the enterprising explorer. Mrs. Bishop recently approached it from the east, through Sze-chuen, and her description of the romantic scenery and the interesting non-Mongolian inhabitants leaves us with a strong desire to learn more. On the south-east of Tibet is the remarkable mountainous region, consisting of a series of lofty parallel chains, through which run the upper waters of the

[1] For part of what follows with reference to Asia, I am indebted to a valuable Memorandum on the subject drawn up by the late Mr. Ney Elias.

Yangtse, the Mekong, the Salwin, and the Irawady. This last-named river, recent exploration has shown, probably does not reach far into the range. But it will be seen by a glance at a map that the upper waters of the other rivers are carried far into the heart of the mountains. But these upper river-courses are entirely conjectural and have given rise to much controversy. There is plenty of work here for the explorer, though the difficulties, physical and political, are great.

But besides these great unexplored regions, there are many blanks to be filled up in other parts of Asia, and regions which, though known in a general way, would well repay careful examination. There is the mountain track between the upper Zarafshan river and the middle course of the Sarkhab tributary of the Oxus, and the country lying between that and the Oxus. There is the great Takla-Makan desert in Chinese or Eastern Turkestan, part of which has recently been explored by Russian expeditions and by that young and indefatigable Swedish traveller, Dr. Sven Hedin. It is now one of the most forbidding deserts to be found anywhere, but it deserves careful examination, as there are evidences of its once having been inhabited, and that at no very remote period. It is almost surrounded by the Tarim, and on its eastern edge lies Lob-nor, the remarkable changes in which have been the subject of recent investigation. As readers of Dr. Nansen's *Voyage of the Fram* will remember, the Siberian coast is most imperfectly mapped; of course, it is a difficult task, but it is one to which the Russian Government ought to be equal. China has on paper the appearance of being fairly well mapped; but as a matter of fact our knowledge of its mountain ranges and of its great river-courses is to a large extent extremely vague. All this awaits careful survey. In North-eastern Manchuria and in many parts of Mongolia there are still blanks to be filled up and mountain and river systems to be surveyed. In the Malay Peninsula and in the great array of islands in the east and south-east of Asia—Sumatra, Borneo, the Philippines—much work still remains to be done. Thus for the coming century there will be abundance of work for explorers in Asia, and plenty of material to occupy the attention of our geographical societies.

Coming to the map of Africa, we find the most marvellous transformation during the last sixty years, and mainly during the last forty years, dating from Livingstone's memorable journey across the continent. Though the north of Africa was the home of one of the oldest civilisations, and though on the shores of the Mediterranean, Phœnicians, Carthaginians, Greeks, and Romans were at work for centuries, it has only been within the memory of many of us that the centre of the continent, from the Sahara to the confines of Cape Colony, has ceased to be an unexplored blank. This blank has been filled up with bewildering rapidity. Great rivers and lakes and mountains have been laid down in their main features, and the whole continent, with a few unimportant exceptions, has been parcelled out among the Powers of Europe. But much still remains to be done ere we can form an adequate conception of what is in some respects the most interesting and the most intractable of the continents. Many curious problems still remain to be solved.

The pioneer work of exploration has to a large extent been accomplished; lines have been run in all directions; the main features have been blocked out. But between these lines the broad meshes remain to be filled in, and to do this will require many years of careful exploration. However, there still remain one or two regions that afford scope for the adventurous pioneer.

To the south of Abyssinia and to the west and north-west of Lake Rudolf, on to the Upper Nile, is a region of considerable extent, which is still practically unknown. Again, in the Western Sahara there is an extensive area, inhabited mainly by the intractable Tuaregs, into which no one has been able to penetrate, and of which our knowledge is extremely scanty. Even in the Central Sahara there are great areas which have not been traversed, while in the Libyan desert much remains to be done. These regions are of interest almost solely from the geographical and geological standpoints. But they deserve careful investigation, not only that we may ascertain their actual present condition, but, in order also, that we may try to discover some clues to the past history of this interesting continent. Still, it must be said that the great features of the continent have been so fully mapped during the last half century that what is required now is mainly the filling-in of the details. This is a process that requires many hands and special qualifications. All over the continent there are regions which will repay special investigation. Quite recently an English traveller, Mr. Cowper, found not far from the Tripoli coast miles of magnificent ruins and much to correct on our maps. If only the obstructiveness of the Turkish officials could be overcome, there is a rich harvest for any one who will go to work with patience and intelligence. Even the interior of Morocco, and especially the Atlas Mountains, are but little known. The French, both in Tunis and Algeria, are extending our knowledge southwards. All the Powers who have taken part in the scramble for Africa are doing much to acquire a knowledge of their territories. Germany, especially, deserves praise for the persistent zeal with which she has carried out the exploration of her immense territories in East and West Africa. The men she sends out are usually well qualified for the work, capable not simply of making a running survey as they proceed, and taking notes on country and people, but of rendering a substantial account of the geology, the fauna, the flora, and the economic conditions. Both in the French and the British spheres good work is also being done, and the map of Africa being gradually filled up. But what we especially want now are men of the type of Dr. J. W. Gregory, whose book on the Great Rift Valley is one of the most valuable contributions to African geography ever made. If men of this stamp would settle down in regions like that of Mount Ruwenzori, or Lake Rudolf, or the region about Lakes Bangweolo and Tanganyika, or in the Atlas, or in many other regions that could be named, the gains to scientific geography, as well as to the economical interests of Africa, would be great. An example of work of this kind is seen in the discoveries made by a young biologist trained in geographical observation, Mr. Moore, on Lake Tanganyika. There he found a fauna which seems to afford a key to the

past history of the centre of the continent, a fauna which, Mr. Moore maintains, is essentially of a salt-water type. Mr. Moore, I believe, is inclined to maintain that the ancient connection of this part of Africa with the ocean was not by the west, as Joseph Thomson surmised, but by the north, through the Great Rift Valley of Dr. Gregory; and he strongly advocates the careful examination of Lake Rudolf as the crucial test of his theory. It is to be hoped that he, or some one equally competent, will have an opportunity of carrying out an investigation likely to provide results of the highest importance.

But there are other special problems connected with this, the most backward and the most repellent of continents, which demand serious investigation, problems essentially geographical. One of the most important of these, from the point of view of the development of Africa, is the problem of acclimatisation. The matter is of such prime importance that a committee of the Association has been at work for some years collecting data as to the climate of Tropical Africa. In a general way we know that that climate is hot and the rainfall scanty: indeed, even the geographers of the Ancient World believed that Central Africa was uninhabitable on account of its heat. But science requires more than generalities, and therefore we look forward with much hope to the exact results which are being collected by the Committee referred to. We can only go to work experimentally until we know precisely what we have to deal with. It will help us greatly to solve the problem of acclimatisation when we have the exact factors that go to constitute the climate of Tropical Africa. At present there is no doubt that the weight of competent opinion—that is, the opinion of those who have had actual experience of African climate, and of those who have made a special study of the effects of that climate on the human constitution—is that though white men, if they take due precautions, may live and do certain kinds of work in Tropical Africa, it will never be possible to colonise that part of the world with people from the temperate zone. This is the lesson taught by generations of experience of Europeans in India. So far, also, sad experience has shown that white people cannot hope to settle in Central Africa as they have settled in Canada and the United States and in Australia, and make it a nursery and a home for new generations. Even in such favourable situations as Blantyre, a lofty region on the south of Lake Nyasa, children cannot be reared beyond a certain age; they must be sent home to England, otherwise they will degenerate physically and morally. No country can ever become the true home of a people if the children have to be sent away to be reared. Still, it is true our experience in Africa is limited. It has been maintained that it might be possible to adapt Europeans to Tropical Africa by a gradual process of migration. Transplant Southern Europeans to North Africa; after a generation or two remove their progeny farther south, and so on, edging the succeeding generation farther and farther into the heart of the continent. The experiment — a long one it would be—might be tried; but it is to be feared that the ultimate result would be a race deprived of all those characteristics which have made Europe what it is. An able young Italian physician, Dr. Sambon, has recently faced this

important problem, and has not hesitated to come to conclusions quite opposed to those generally accepted. His position is that it has taken us centuries in Europe to discover our hidden enemies, the microbes of the various diseases to which Northern humanity is a prey, and to meet them and conquer them. In Africa we have a totally different set of enemies to meet, from lions and snakes down to the invisible organisms that produce those forms of malaria, anæmia, and other diseases characteristic of tropical countries. He admits that these are more or less due to heat, to the nature of the soil, and other tropical conditions, but that if once we knew their precise nature and modes of working we should be in a position to meet them and conquer them. It may be so, but this is a result that could only be reached after generations of experience and investigation: and even Dr. Sambon admits that the ultimate product of European acclimatisation in Africa would be something quite different from the European progenitors. What is wanted is a series of carefully conducted experiments. I have referred to the Blantyre highlands; in British East Africa there are plateaus of much greater altitude, and in other parts of Central Africa there are large areas of 4000 feet and over above sea-level. The world may become so full that we may be forced to try to utilise these lofty tropical regions as homes for white people when Canada and Australia and the United States become over-populated. As one of my predecessors in this chair (Mr. Ravenstein) tried to show at the Leeds Meeting some years ago, the population of the world will have more than doubled in a century, and about 180 years hence will have quadrupled. At any rate, here is a problem of prime importance for the geographer of the coming century to attack; with so many energetic and intelligent white men all over Africa, it should not be difficult to obtain the data which might help towards its solution.

I have dwelt thus long on Africa, because it will really be one of the great geographical problems of the coming century. Had it been as suitable as America or Australia, we may be sure it would not have remained so long neglected and despised by the European peoples as it has done. Unfortunately for Africa, just as it had been circumnavigated, and just as Europeans were beginning to settle upon its central portion and trying to make their way into the interior, Columbus and Cabot discovered a new world, a world as well adapted as Europe for the energies of the white races. That discovery postponed the legitimate development of Africa for four centuries. Nothing could be more marked than the progress which America has made since its re-discovery 400 years ago, and the stagnation of Africa which has been known to Europe since long before the beginning of history. During these 400 years North America at least has been very thoroughly explored. The two great nations which divide North America between them have their Government surveys, which are rapidly mapping the whole continent and investigating its geology, physical geography, and its natural resources. I need hardly tell an audience like this of the admirable work done by the Survey of Canada under Sir William Logan, Dr. Selwyn, and his successor, Dr. George Dawson; nor should it be forgotten that under the Lands Department much excellent topographical work has been

carried out by Captain Deville and his predecessors. Still, though much has been done, much remains to be done. There are large areas which have not as yet even been roughly mapped. Within quite recent years we have had new regions opened up to us by the work of Dawson and Ogilvie on the Yukon, by Dr. Bell in the region to the south of Hudson's Bay, by the brothers Tyrrell in the Barren Lands on the west of the same bay, by O'Sullivan beyond the sources of Ottawa, and by Low in Labrador. But it is not so long since that Dr. Dawson, in reviewing what remains to be done in the Dominion in the way of even pioneer exploration, pointed out that something like a million square miles still remained to be mapped. Apart from the uninhabitable regions in the north, there are, as Dr. Dawson pointed out, considerable areas, which might be turned to profitable agricultural and mining account, of which we know little, such areas as these which have been recently mapped on the south of Hudson's Bay by Dr. Bell, and beyond the Ottawa by Mr. O'Sullivan. Although the Eastern and the Western Provinces have been very fully surveyed, there is a considerable area between the two lying between Lake Superior and Hudson's Bay which seems to have been so far almost untouched. A very great deal has been done for the survey of the rivers and lakes of Canada. I need hardly say that in Canada, as elsewhere in America, there is ample scope for the study of many problems in physical geography—past and present glaciation and the work of glaciers, the origin and *régime* of lake basins, the erosion of river-beds, the oscillation of coast-lines. Happily, both in Canada and the United States there are many men competent and eager to work out problems of this class, and in the reports of the various surveys, the Transactions of American learned Societies, in scientific periodicals, in separate publications, a wealth of data has already been accumulated of immense value to the geographer.

Every geologist and geographer knows the important work which has been accomplished by the various surveys of the United States, as well as by the various State Surveys. The United States Coast Survey has been at work for more than half a century, mapping not only the coast but all the navigable rivers. The Lake survey has been doing a similar service for the shores of the great lakes of North America. But it is the work of the Geological Survey which is best known to geographers—a survey which is really topographical as well as geological, and which, under such men as Hayden, King, and Powell, has produced a series of magnificent maps, diagrams, and memoirs of the highest scientific value and interest. Recently this survey has been placed on a more systematic basis; so that now a scheme for the topographical survey of the whole of the territory of the United States is being carried out. Extensive areas in various parts of the States have been already surveyed on different scales. It is to be hoped that in the future, as in the past, the able men who are employed on this survey work will have opportunities of working out the physiography of particular districts, the past and present geography of which is of advancing scientific interest. Of the complete exploration and mapping of the North American continent we need have no apprehension; it is only a question of time, and it is to be

hoped that neither of the Governments responsible will allow political exigencies to interfere with what is really a work of national importance.

It is when we come to Central and South America that we find ample room for the unofficial explorer.[1] In Mexico and the Central American States there are considerable areas of which we have little or only the vaguest knowledge. In South America there is really more room now for the pioneer explorer than there is in Central Africa. In recent years the Argentine Republic has shown a laudable zeal in exploring and mapping its immense territories, while a certain amount of good work has also been done by Brazil and Chile. Most of our knowledge of South America is due to the enterprise of European and North American explorers. Along the great river-courses our knowledge is fairly satisfactory, but the immense areas, often densely clad with forests, lying between the rivers are almost entirely unknown. In Patagonia, though a good deal has recently been done by the Argentine Government, still in the country between Punta Arenas and the Rio Negro, we have much to learn; while on the west-coast range, with its innumerable fjord-like inlets, its islands and peninsulas, there is a fine field for the geologist and physical geographer. Indeed, throughout the whole range of the Andes systematic exploration is wanted, exploration of the character of the excellent work accomplished by Whymper in the region around Chimborazo. There is an enormous area lying to the east of the Northern Andes, and including their eastern slopes, embracing the eastern half of Ecuador and Colombia, Southern Venezuela, and much of the country lying between that and Northern Bolivia, including many of the upper tributaries of the Amazon and Orinoko, of which our knowledge is of the scantiest. Even the country lying between the Rio Negro and the Atlantic is but little known. There are other great areas, in Brazil and in the Northern Chaco, which have only been partially described, such as the region whence the streams forming the Tapajos and the Paraguay take their rise, in Mato Grosso. A survey and detailed geographical and topographical description of the whole basin of Lake Titicaca is a desideratum. In short, in South America there is a wider and richer field for exploration than in any other continent. But no mere rush through these little-known regions will suffice. The explorer must be able to use more than his sextant and his theodolite, his compass and his chronometer. Any expeditions entering these regions ought to be able to bring back satisfactory information on the geology of the country traversed, and of its fauna and flora, past and present; already the revelations which have been made of the past geography of South America, and of the life that flourished there in former epochs, are of the highest interest. Moreover, we have here the remains of extinct civilisations to deal with, and although much has been done in this direction, much remains to be done, and in the extensive region already referred to, the physique, the traditions, and the customs of the natives will repay careful investigation.

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[1] I am indebted for much of the information relative to South America to a valuable Memorandum by Sir Clements R. Markham and Colonel G. E. Church.

The southern continent of Australia is in the hands of men of the same origin as those who have developed to such a wonderful extent the resources of Canada and the United States, and therefore we look for equally satisfactory results so far as the characteristics of that continent permit. The five colonies which divide among them the three million square miles of the continent have each of them efficient Government surveys, which are rapidly mapping their features and investigating their geology. But Australia has a trying economic problem to solve. In none of the colonies is the water-supply quite adequate; in all are stretches of desert country of greater or less extent. The centre and western half of the continent is covered by a desert more waterless and more repellent than even the Sahara; so far as our present knowledge goes, one-third of the continent is uninhabitable. This desert area has been crossed by explorers, at the expense of great sufferings, in various directions, each with the same dreary tale of almost featureless sandy desert, covered here and there with spinifex and scrub, worse than useless. There are hundreds of thousands of square miles still unknown, but there is no reason to believe that these areas possess any features that differ essentially from those which have been found along the routes that have been explored. There have been one or two well-equipped scientific expeditions in recent years that have collected valuable data with regard to the physical characteristics, the geology and biology of the continent; and it is in this direction that geography should look for the richest results in the future. There remains much to be done before we can arrive at satisfactory conclusions as to the physical history of what is in some respects the most remarkable land area on the globe. Though the surface water supply is so scanty, there is reason to believe that underneath the surface there is an immense store of water. In one or two places in Australia, especially in Western Queensland and in New South Wales, this supply has been tapped with satisfactory results; millions of gallons a day have been obtained by sinking wells. Whether irrigation can ever be introduced on an extensive scale into Australia depends upon the extent and accessibility of the underground water-supply, and that is one of the geographical problems of the future in Australia. New Zealand has been fairly well surveyed, though a good deal remains to be done before its magnificent mountain and glacier system is completely known. In the great island of New Guinea both the British and the Germans are opening up the interiors of their territories to our knowledge, but the western and much larger portion of the island presents a large field for any explorer who cares to venture into its interior.

The marvellous success which has attended Dr. Nansen's daring adventure into the Arctic seas has revived a widespread interest in Polar exploration. Nansen may be said to have almost solved the North Polar problem—so far, at least, as the Old World side of the Pole is concerned. That some one will reach the Pole at no distant date is certain; Nansen has shown the way, and the legitimate curiosity of humanity will not rest satisfied till the goal be reached. But Arctic exploration

does not end with the attainment of the Pole. Europe has done her share on her own side of the Pole; what about the side which forms the Hinterland of North America, and specially of Canada? To the north of Europe and Asia we have the scattered groups of islands, Spitsbergen, Franz Josef Land, Novaya Zemlya, and the New Siberian Islands. To the north of America we have an immense archipelago, the actual extent of which is unknown. Nansen and other Arctic authorities maintain that the next thing to be done is to complete exploration on the American side, to attempt to do for that half of the North Polar region what Nansen has done for the other half. It may be that the islands which fringe the northern shores of the New World are continued far to the north; if so, they would form convenient stages for the work of a well-equipped expedition. It may be that they do not go much farther than we find them on our maps. Whatever be the case, it is important, in the interests of science, that this section of the Polar area be examined; that as high a latitude as possible be attained; that soundings be made to discover whether the deep ocean extends all round the Pole. It is stated that the gallant Lieutenant Peary has organised a scheme of exploring this area which would take several years to accomplish. Let us hope that he will be able to carry out his scheme. Meantime, should Canada look on with indifference? She has attained the standing of a great and prosperous nation. She has shown the most commendable zeal in the exploration of her own immense territory. She has her educational, scientific, and literary institutions, which will compare favourably with those of other countries; her Press is of a high order, and she has made the beginnings of a literature and an art of her own. In these respects she is walking in the steps of the Mother Country. But has Canada not reached a stage when she is in a position to follow the maternal example still further? What has more contributed to render the name of Great Britain illustrious than those great enterprises which for centuries she has sent out from her own shores, not a few of them solely in the interests of science? Such enterprises elevate a nation and form its glory and its pride. Surely Canada has ambitions beyond mere material prosperity, and what better beginning could be made than the equipment of an expedition for the exploration of the seas that lie between her and the Pole? I venture to throw out these suggestions for the consideration of those who have at heart the honour and glory of the great Canadian Dominion.

Not only has an interest in Arctic exploration been revived, but in Europe at least an even greater interest has grown up in the exploration of the region around the opposite pole of the earth of which our knowledge is so scanty. Since Sir James C. Ross's expedition, which was sent out in the year 1839, almost nothing has been done for Antarctic research. We have here to deal with conditions different from those which surround the North Pole. Instead of an almost landless ocean, it is believed by those who have given special attention to the subject that a continent about the size of Australia covers the south polar region. But we don't know for certain, and surely, in the interests of our science, it is time we had a fairly adequate idea of what are the real conditions. We want to

know what is the extent of that land, what are its glacial conditions, what is the character of its geology, what evidence exists as to its physical and biological conditions in past ages? We know there is one lofty, active volcano; are there any others? Moreover, the science of terrestrial magnetism is seriously impeded in its progress because the data in this department from the Antarctic are so scanty. The seas around this continent require to be investigated both as to their depth, their temperature, and their life. We have here, in short, the most extensive unexplored area on the surface of the globe. For the last three or four years the Royal Geographical Society, backed by other British societies, have been attempting to move the Home Government to equip an adequate expedition to complete the work begun by Ross sixty years ago, and to supplement the great work of the *Challenger*. But though sympathy has been expressed for Antarctic exploration, and though vague promises have been given of support, the Government is afraid to enter upon an enterprise which might involve the services of a few naval officers and men. We need not criticise this attitude. But the Royal Geographical Society has determined not to let the matter rest here. It is now seeking to obtain the support of public-spirited men for an Antarctic expedition under its own auspices. It is felt that Antarctic exploration is peculiarly the work of Britain, and that if an expedition is undertaken, it will receive substantial support from the great Australian Colonies, which have so much to gain from a knowledge of the physical condition of a region lying at their own doors, and probably having a serious influence on their climatological conditions. Here, then, is one of the greatest geographical problems of the future, the solution of which should be entered upon without further delay. It may be mentioned that a small and well-equipped Belgian expedition has already started, mainly to carry out deep-sea research around the South Polar area, and that strenuous efforts are being made in Germany to obtain the funds for an expedition on a much larger scale.

But our science has to deal not only with the lands of the globe; its sphere is the whole of the surface of the earth, and all that is thereon, so far at least as distribution is concerned. The department of Oceanography is a comparatively new creation: indeed, it may be said to have come definitely into being with the famous voyage of the *Challenger*. There had been expeditions for ocean investigation before that, but on a very limited scale. It has only been through the results obtained by the *Challenger*, supplemented by those of expeditions that have examined more limited areas, that we have been able to obtain an approximate conception of the conditions which prevail throughout the various ocean depths—conditions of movement, of temperature, of salinity, of life. We have only a general idea of the contours of the ocean-bed, and of the composition of the sediment which covers that bed. The extent of the knowledge thus acquired may be gauged from the fact that it occupies a considerable space in the fifty quarto volumes—the *Challenger Publications*—which it took Dr. John Murray twenty years to bring out. But that great undertaking has only, as it were, laid down the general features of the oceanic world. There is plenty of room for further

research in this direction. Our own surveying ships, which are constantly at work all over the world, do a certain amount of oceanic work, apart from mere surveying of coasts, and islands, and shoals. In 1895 one of these found in the South Pacific soundings deeper by 500 fathoms than the deepest on record, that found twenty years earlier by the *Tuscarora* to the north-east of Japan. The deepest of these new soundings was 5155 fathoms. In the interests of science, as well as of cable-laying, it is desirable that our surveying ships should be encouraged to carry out work of this kind more systematically than they do at present. This could surely be arranged without interfering with their regular work. We want many more observations than we now have, not only on ocean depths, but on the nature of the ocean-bed, before we can have a satisfactory map of this hidden portion of the earth's surface, and form satisfactory conclusions as to the past relations of the ocean-bed with what is now dry land. I believe the position maintained by geologists, that from the remote period when the great folds of the earth were formed, the present relations between the great land-masses and the great oceans have been essentially the same; that there have no doubt been great changes, but that these have been within such limits as not to materially affect their relations as a whole. This is a problem which further oceanic research would go a long way to elucidate. That striking changes are going on at the present day, and have been going on within the human period, cannot be doubted. Some coast-lines are rising; others are falling. Professor John Milne, our great authority on Seismology, has collected an extremely interesting series of data, as to the curious changes that have taken place in the ocean-bed since telegraphic cables have been laid down. The frequent breakages of cables have led to the examination of the sub-oceanic ground on which they have been laid, and it is found that slides and sinkings have occurred, in some cases amounting to hundreds of fathoms. These, it is important to note, are on the slopes of the Continental Margin, or, as it is called, the Continental Shelf, as, for example, off the coast of Chile. It is there, where the earth's crust is peculiarly in a state of unstable equilibrium, that we might expect to find such movements; and therefore soundings along the Continental Margins, at intervals of say five years, might furnish science with data that might be turned to good account.

As an example of what may be done by a single individual to elucidate the present and past relations between land and sea, may I refer to an able paper in the *Geographical Journal* of May 1897, by Mr. T. P. Gulliver, a pupil of Professor Davis, of Harvard, himself one of the foremost of our scientific geographers? Mr. Gulliver has made a special study on the spot, and with the help of good topographical and geological maps, of Dungeness Foreland on the south-east coast of Kent. Mr. Gulliver takes this for his subject, and works out with great care the history of the changing coast-line here, and in connection with that the origin and changes of the English Channel. This is the kind of work that well-trained geographical students might undertake. It is work to be encouraged, not only for the results to be obtained, but as one species of practical geographical training in the field, and as a reply to those who

maintain that geography is mere book-work, and has no problems to solve. Professor Davis himself has given an example of similar practical work in his elaborate paper on "The Development of Certain English Rivers," in the *Geographical Journal* for February 1895 (vol. v. p. 127), and in many other publications.

Another important problem to attack, and that in the near future, is that of Oceanic Islands. I say in the near future, because it is to be feared that very few islands now remain unmodified by contact with Europeans. Not only have the natives been affected, both in physique and in customs, but the introduction of European plants and animals has to a greater or less extent modified the native fauna and flora. Dr. John Murray, of the *Challenger*, has set a good example in this direction by sending a young official from the Natural History Museum to Christmas Island, in the Indian Ocean, one of the few untouched islands that remain, lying far away from any other land, to the south-east of the Keelings.

What islands are to the ocean, lakes are to the land. It is only recently that these interesting geographical features have received the attention they deserve. Dr. Murray has for some time been engaged in investigating the physical conditions of some of the remarkable lakes in the West of Scotland. Some three years ago my friend and colleague Dr. Mill carried out a very careful survey of the English lakes, under the auspices of the Royal Geographical Society. His soundings, his observations of the lake conditions, of the features on the margins of and around the lakes, when combined with the investigation of the *régime* of the rivers and the physical geography of the surrounding country, conducted by such accomplished geologists as Mr. Marr, afford the materials for an extremely interesting study in the geographical history of the district. On the Continent, again, men like Professor Penck, of Vienna, have been giving special attention to lakes, that accomplished geographer's monograph on Lake Constance, based on the work of the five States bordering its shores, being a model work of its kind. But the father of Limnology, as this branch of geography is called, is undoubtedly Professor Forel, of Geneva, who for many years has been investigating the conditions of that classical lake, and who is now publishing the results of his research. Dr. Forel's paper on "Limnology: a Branch of Geography," and the discussion which follows in the *Report* of the last International Geographical Congress, affords a very fair idea in short space of the kind of work to be done by this branch of the science. In France, again, M. Delebecque is devoting himself to a similar line of research; in Germany, Ule, Halbfass, and others; Richter in Austria, and the Balaton Commission in Hungary. I may also here refer appropriately to Mr. Israel C. Russell's able work, published in Boston in 1895, on "The Lakes of North America," in which the author uses these lakes as a text for a discourse on the origin of lake basins and the part played by lakes in the changes studied by dynamic geology. One of the best examples of an exhaustive study of a lake basin will be found in the magnificent monograph on Lake Bonneville, by Mr. G. K. Gilbert, and that on Lake Lahonton by Mr. Israel Cook Russell, published by the United States Geological Survey; the former

is indeed a complete history of the great basin, the largest of the interior drainage areas of the North American continent. In the publications of the various Surveys of the United States as well as in the official reports of the Canadian Lake Surveys, a vast amount of material exists for any one interested in the study of lakes; in addition, the elaborate special Reports on the great lakes by the Hydrographic Department. Indeed, North America presents an exceptionally favourable field for limnological investigation; if carried out on a systematic method the results could not but be of great scientific interest.

Rivers are of not less geographical interest than lakes, and these have also recently been the subject of special investigation by physical geographers. I have already referred to Professor Davis's study of a special English river-system. The work in the English Lake District by Mr. Marr, spoken of in connection with Dr. Mill's investigations, was mainly on the hydrology of the region. Both in Germany and in Russia special attention is being given to this subject, while in America there is an enormous literature on the Mississippi alone, mainly, no doubt, from the practical standpoint, while the result of much valuable work on the St. Lawrence is buried in Canadian official publications.

But time does not admit of my going further. I might have pointed out the wide and vastly interesting field presented by what the Germans call Anthropogeography, dealing with the interrelations between humanity and its geographical environment. Geography, Mr. Mackinder has said, is the physical basis of history; it is, indeed, the physical basis of all human activity, and from that standpoint the field for geographical research is unbounded. But I can only hint at this. I have endeavoured to indicate what are some of the leading geographical problems of the future, first in order to show at this somewhat critical epoch how very much yet remains to be done, how many important lines of inquiry are open to the geographical student, and that the possibilities of our science are, like those of other departments of research, inexhaustible. My aim has also been to indicate by actual examples what, in the conception of British geographers at least, is the field of our subject. We need not trouble greatly about any precise definition so long as there is such a choice of work for the energies of the geographer. I trust I have been, to some extent at least, successful in the double object which I have had in view in this opening address in a country which presents so splendid a field to the practical geographer.

THE PREHISTORIC ROCK-SHELTER AT SCHWEIZERSBILD, NEAR SCHAFFHAUSEN.

By Professor James Geikie, D.C.L., LL.D., F.R.S.

A most interesting discovery of prehistoric remains has recently been made by Dr. Nüesch of Schaffhausen. Incited by the accounts of the French, Belgian, and English finds of palæolithic relics in caves and rock-

shelters, Dr. Nüesch began many years ago to search for similar evidence in the numerous limestone-caves of his own canton. The discovery by Mr. C. Merk of the famous Kesserloch, near Thayngen, satisfied Dr. Nüesch that he was on the right track, and between 1872 and 1891 he had perseveringly examined some sixty or seventy likely places, but, unfortunately, with no success. After this he might have been excused had he lost heart; but, stimulated by the discoveries which continued to be made elsewhere, he did not slacken his endeavours, until at last good fortune came to him at the Schweizersbild in his own neighbourhood. The Schweizersbildthal lies some two miles north of Schaffhausen, on the way to Merishausen. It is a pleasant tree-girt meadow, in the midst of which rise some isolated stacks of limestone. From the top of these rocks a wide view is obtained of all the adjacent valleys and heights, so that the place has always been a favourite resort of sportsmen. Here under the overhanging rocks they find shelter from wind and weather, and welcome shade from the noontide sun. No doubt it was for similar reasons that the Schweizersbild commended itself to the old reindeer-hunters whose relics Dr. Nüesch has been so fortunate as to unearth.

At the base of one of the stacks of limestone the explorer began to dig, and underneath a talus of vegetable soil and angular blocks and débris, which last had obviously fallen from the overhanging rock, worked flints, etc., were come upon. Dr. Nüesch, therefore, resolved to have the accumulations carefully and systematically laid bare—an expensive and laborious operation, for which he had himself to undertake the responsibility—the local scientific society being unable to supply the necessary funds. The exploration was commenced in the autumn of 1891, and successfully concluded in 1893. Short notices and papers descriptive of the general results obtained were shortly afterwards published, but it is only now that we have a full and elaborate account from the pen of Dr. Nüesch himself,[1] the delay having arisen partly because of the abundance of materials to be examined, and partly, as we are sorry to learn, because of the severe illness of the author.

In order to give our readers a clear notion of the story told by the deposits in the rock-shelter, we shall first set down here the succession of "beds" with their average thickness. The beds are numbered from the bottom upwards:—

6. Humus-bed: 40—50 cm.
5. Grey Relic-bed: 40 cm.
4. Breccia-bed: average 80 cm. This bed was divided in two by a thin layer (about 10 cm.) termed the Upper Rodent-bed.
3. Yellow Relic-bed: 30 cm.
2. Lower Rodent-bed: 50 cm.
1. Gravel-bed: dug to a depth of some yards.

The lowest bed (1) is of much interest from the fact that it unquestionably belongs to the Glacial Period—Professor Penck and several

[1] "Das Schweizersbild, eine Niederlassung aus paläolithischer und neolithischer Zeit." *Denkschr. d. Schweiz. Naturforschenden Gesellschaft*, Bd. xxxv.

others having conclusively shown that it is a river-deposit formed during the retreat of the great glaciers of the third glacial epoch of Swiss geologists.

The *Lower Rodent-bed* is a yellowish earth, containing many fragments of limestone, and the relics of a very remarkable fauna—such a fauna as we now meet with only in the extreme north-east of Europe and in Northern Siberia, where the characteristic forms are lemmings (*Myodes torquatus*; *M. obensis*), arctic fox, mountain-hare, reindeer, and musk-ox. Such are the most characteristic animals of the Tundra, but along with them are frequently associated northern field-vole, water-rat, glutton, common weasel, ermine, wolf, fox, and bear. Of these fourteen Tundra forms, twelve are met with in the *Lower Rodent-bed* of the Schweizersbild. The only species that do not occur are the Obi lemming and the musk-ox. The former, however, has a somewhat more southern range than the torquated lemming, while the remains of the musk-ox have been met with in the Kesserloch—a cave which occurs in the same neighbourhood. Along with the Tundra mammals of the Schweizersbild various birds were associated, such as ptarmigans, grouse, pin-tail duck, buntings, owls, falcons, etc.—an assemblage quite comparable with the bird-life of the Siberian Tundras. The arctic fox and the torquated lemming are especially characteristic of these far northern regions, and their presence at the Schweizersbild is therefore peculiarly significant. They range as far northwards as land extends, and are met with even in the islands of the frozen ocean. We cannot doubt, therefore, that while the lower portions of the *Rodent-bed* were being slowly accumulated, an arctic climate reigned in North Switzerland.

As the *Rodent-bed* and its contents are more narrowly scanned, it becomes obvious that the climate was beginning to change before the accumulation of the bed was completed. The Tundra fauna was still in possession of the land when representatives of a sub-arctic Steppe fauna began to put in an appearance. Amongst these new-comers were the little hamster (*Cricetus phœus*), common hamster, Siberian social vole, pika or tailless hare, wild horse, and woolly rhinoceros. Thus as we pass from the lower to the upper portion of the bed, a gradual change comes over the fauna—some species disappear, while new arrivals take their place. The extreme arctic conditions, evinced by the presence of a characteristic Tundra fauna, were thus eventually superseded by a climate resembling that of the sub-arctic steppe lands of Europe-Asia.

The most abundant remains in the *Lower Rodent-bed* were those of torquated lemming—"the warmth-hater"—as Middendorf has called it. The bones of this lemming and those of the birds are not broken, as are those of the larger animals. These last occur in small quantity—the most common being those of the alpine hare. Evidence of man's presence is furnished by flint implements, and by awls, chisels, harpoons, and needles fashioned out of bone and horn. Most of the bones appear as if they had been broken with stone-hammers, not a single marrow-bone having escaped such treatment. Throughout the entire thickness of the *Lower Rodent-bed*, however, only one old hearth with its ashes was encountered. From the fact that no burnt bones have been met with,

and from the small number of worked bones and antlers, contrasting so strongly with their abundance in the overlying beds, it is inferred that man was not a persistent occupant of the Schweizersbild rock-shelter during the accumulation of the *Lower Rodent-bed*. This is further suggested by the occurrence, especially in the upper part of that bed, of abundant traces of various birds of prey, which appear to have been able to nest undisturbed on the rock and in its crevices. Probably at that stage the surrounding country had no large leafy trees or pine-forests, and supported merely dwarf bushes and scrub.

The next succeeding layer (the *Yellow Relic-bed*) owes its yellowish-red colour to an admixture of yellow loam, yellow-stained bones, and numerous stones which have been reddened by the action of fire. The whole bed proved to be rich in relics of man. It yielded some 14,000 flint implements, and a large number of worked bones and antlers, comprising needles, bodkins and awls, chisels, harpoons, reindeer-whistles, etc. Bits of wood, worked and charred, and fragments of worked and unworked lignite, were also obtained. Besides these, drawings and patterns were found on reindeer-antlers, on bones, and on tablets of limestone, while many shells, fossils, and teeth of the arctic fox and the glutton were met with, bored and pierced as if they had been used for necklaces and other personal ornaments. The presence throughout the relic-bed of nuclei or cores from which flints had been struck, of abundant chips and splinters, of old hearths, ashes, and burnt bones, of stones discoloured and cracked by the action of fire, all leads to the conclusion that the reindeer-hunters were constant occupants of the Schweizersbild during the accumulation of the *Yellow Relic-bed*. A large number of "fossils," and various minerals, were found scattered through the bed. Some of these have come from no great distance, but others could not have been obtained in Switzerland. Either on account of their shape, their appearance, their colour, their size, or other character, they had somehow taken the fancy of the reindeer-hunters. No doubt some of them were used as ornaments by the men and women, while others may have been playthings for the children. Their presence, however, shows that the hunters sometimes wandered many miles away—to north, west, and east. The occurrence of certain fossils, which in all probability have come from near Mainz and from the neighbourhood of Ulm, seems to show that the valleys of the Rhine and the Danube may have been the "trade-routes" of the period, the fossils being used in barter. The stone implements employed by the reindeer-hunters were not exclusively flint—various other hard rocks were utilised—all of which could be obtained in the immediate neighbourhood. It is interesting to note, too, that slabs of schistose, and other readily split rocks, were found disposed symmetrically round the hearths, as if for seats. Anvils of granite were seen half-buried in chips, splinters, nuclei, and spoilt implements of flint.

Turning to the abundant animal remains, we find that these represent no fewer than forty-nine different species—thirty of which are mammals, fifteen birds, three amphibians, and one fish. Comparing this fauna with that of the *Rodent-bed*, we see that the most characteristic Tundra form—

the torquated lemming—is no longer represented. So, in like manner, no trace is found of lesser shrew, little hamster, bank-vole, alpine vole, Siberian social vole, northern field-vole, parti-coloured bat, rhinoceros, hawk-owl (*Surnia nisoria*), kestrel, etc. On the other hand, many new arrivals make their appearance. Amongst these are Pallas's cat (*Felis manul*), spider musk-shrew, red suslik or sisel (*Spermophilus rufescens*), alpine ibex, Persian maral, kiang or dzeggetai, pine marten, beaver, squirrel, red deer, roe-deer, wild boar; various birds, including grouse, fieldfare, golden eagle, alpine lark, etc; and species of toad, frog, and snake.

This is a Steppe fauna, although not quite so characteristic and well marked as the Tundra fauna of the *Lower Rodent bed*. We note the absence of jerboa, but other not less characteristic Steppe animals are present, such as the red suslik, the pika, and the true hamster. As constant visitors of the steppe-lands we note further Pallas's cat, wild horse and dzeggetai, and some birds; while associated with these are several representatives of a sub-arctic and alpine fauna, as the arctic fox, glutton, mountain-hare, alpine ibex, and various birds. Amongst this company red deer, roe, wild boar, squirrel, pine marten, and beaver—all belonging to a Forest fauna—seem out of place. It is to be noted, however, that they are represented by very few remains, and further that these are entirely restricted to the uppermost part of the relic-bed, where the division between that bed and the overlying layer was not very sharply defined. Yet a Forest fauna might quite well have been contemporaneous with a Steppe fauna in Switzerland. It is quite possible that some of the lower heights of the neighbourhood may have been covered with a scrub of birch and pine which would give shelter to deer, boars, martens, and squirrels, while bears and gluttons haunted some of the numerous open rock fissures, and owls and falcons nested in the cliffs.

The remains of reindeer are extremely abundant in the *Yellow Relic-bed*—so abundant that Dr. Nüesch estimates that the teeth, jawbones, and phalanges represent 500 individuals. But this estimate is probably too low. It would appear that the old hunters did not carry the entire carcase of a deer into the rock-shelter at the Schweizersbild. They cut it up where they had killed the animal, taking with them only the haunch and the hide, with the feet, and usually the head. Hence ribs, vertebræ, and bones of the pelvis are very seldom met with, while fragments of the skull are not very plentiful. Both full-grown and young individuals are represented—the latter in astonishing numbers, it being computed that about one-third of the entire mass of bones are those of young deer. From this it has been inferred that the reindeer may have been domesticated, or else that the herds were so large that even with his imperfect weapons the hunter could have no difficulty in bringing down the victims he selected. In one of the drawings of reindeer found in the *Yellow Relic-bed*, it may be noted, that double lines are shown passing along the side of the animal as if they were meant to represent a rein.

In fine, we have here a well-marked dwelling-place of the reindeer-hunter of Palæolithic times. The various weapons and tools coming

from the *Lower Rodent-bed* and the *Yellow Relic-bed* are all of the same type—that, namely, which is characteristically represented by the implements found at La Madelaine in the valley of the Vézère in Southern France.

The next succeeding stratum is the *Breccia-bed* with the *Upper Rodent-bed*. The breccia consists of angular fragments of limestone of the size of peas to walnuts, either lying loosely together or cemented by calcareous matter. Where the bed was undisturbed it reached a maximum of 120 cm., and was similar in character throughout. The whole of the materials have no doubt been derived from the gradual weathering of the overhanging rock, and their accumulation implies a long period of time. Relics of man are not so abundantly met with in this stratum as in the *Yellow Relic-bed*. Nevertheless, sporadic splintered bones and flint-chips occurred all through the breccia, and here and there they were even abundant. About midway between the top and bottom of the breccia a layer of dark earth made its appearance in which traces of man's handiwork and remains of rodents were conspicuous; this is the *Upper Rodent-bed*. Dr. Nüesch is of opinion that during the formation of the breccia small groups of reindeer-hunters now and again visited the Schweizersbild, just as had been the case during the formation of the *Lower Rodent-bed* with its Tundra fauna. The assemblage of animal remains occurring in the breccia-bed shows very clearly that the climatic conditions were changing. The steppe climate was passing away and forests were becoming dominant. Amongst the species met with in the *Upper Rodent-bed* are reindeer, hare, pika, squirrel-tailed dormouse, garden dormouse, squirrel, water-rat, various voles, shrews, mole, weasel, ermine, marten, etc. This is obviously a mixed fauna—a few of the steppe animals being still represented, but the larger number of the species are "forest" forms. In short, we may look upon the fauna of the breccia-bed as marking the transition from steppe to forest conditions. During the formation of the breccia the climate was gradually becoming warmer—the forests continuing to increase at the expense of the older steppe flora. The presence of man is indicated not only by split bones and worked flints, but by the ashes of his fires. No objects fashioned of bone and horn, however, were met with.

The *Grey Relic-bed* is the stratum next in succession. This bed varies considerably in character, but is noteworthy for the extraordinary quantity of ashes which it contains. Large blocks of limestone were found round what seems to have been a central fireplace, while slabs of the same rock probably represented an old hearth. Besides these were many fragments of other rocks, together with fossils, shells, worked flints, bones, and antlers, human skeletons, red unglazed potsherds, and other relics of Neolithic man. Traces of at least twenty-two interments were discovered. These graves were sunk into the underlying Palæolithic beds, and naturally enough, therefore, some Palæolithic relics were here and there found in the *Grey Relic-bed*. But in places where no interments had taken place, the latter bed possessed quite a distinctive character, and was clearly recognisable as Neolithic. Many considerations lead Dr. Nüesch to believe that during the long Neolithic period the

Schweizersbild was not occupied as a dwelling-place, but was simply visited from time to time for burial purposes. He thinks it is also highly probable that the great accumulation of ashes in certain places indicates that here Neolithic man sometimes burnt his dead.

The fauna of the *Grey Relic-bed* includes brown bear, badger, marten, wolf, fox, mole, hare, beaver, squirrel, hamster, water-rat, urus, ox (*Bos taurus Brachyceros*), goat, sheep, red deer, roe-deer, reindeer, wild boar, horse, and ptarmigan. Of these badger, wild-cat, hare, urus, ox, goat, and sheep are new-comers, no trace of which is met with in the *Yellow Relic-bed*. Amongst the species present in palæolithic times the following are now wanting: Pallas's cat, arctic fox, ermine, weasel, glutton, spider musk-shrew, field-vole, red suslik, pika, Alpine hare, bison, ibex, kiang, Persian maral, and all the birds with the exception of ptarmigan. The most abundant remains were those of the red deer, after which came those of roe-deer, horse, and ox. Neglecting the reindeer—the remains of which may have been derived from some of the older beds—it is obvious that the fauna of the *Grey Relic-bed* is a true Forest fauna.

Among the Neolithic interments ten were of children—three of these new-born infants, while the others were respectively three months, two years, four years, and seven years old when they died. Two of the infants had been buried with their mothers, and their graves contained no relics, while those of the other children did, the relics consisting of shells and finely finished flint implements. The great care with which the graves have been constructed, and the presence of the ornaments and other valuable objects placed beside his dead little ones, show how strong was Neolithic man's family affection. The new-born infants were laid each within the right arm of its mother, while with the left arm stretched across her breast the latter seemed to hold the little one fast. The examination of the skeletons of fourteen adults shows that during Neolithic times the Schweizersbild was frequented by two distinctly different races. One of these was of fair stature (1600 mm. and more), while the other was much smaller—a true pygmy race. Professor Kollmann, who has described the remains, is quite certain that the dwarflike proportions of the latter have nothing in common with diseased conditions. This, from many points of view, is a highly interesting discovery. It is possible, as Dr. Nüesch suggests, that the widely-spread legend as to the former existence of little men, dwarfs, and gnomes, who were supposed to haunt caves and retired places in the mountains, may be a reminiscence of these Neolithic pygmies.

The highest-lying accumulation—the *Humus-bed*—is an agglomeration of breccia, earth, and rolled stones, through which were scattered various human relics—ancient and modern, such as glazed and unglazed potsherds, fragments of hand-made tiles, of modern bricks and clay-pipes, of glass of all kinds, coloured and colourless, iron nails of old and recent kinds, buttons of metal, bone, and horn, ancient and modern metal rings, bronze needles with and without eyes, beads, etc. Along with these occurred many bones—the relics of hunters' repasts. Amongst these remains were those of domestic cat, beech marten, hare, rabbit, ox, sheep, elk, red deer, roe, domestic pig, horse, pigeon, and goose—a fauna like

that of the present. The elk, it is believed, was an occupant of the neighbourhood during the middle ages.

Dr. Nüesch makes a rough estimate of the time required for the accumulation of the several deposits met with in this most interesting rock-shelter. Assuming that the Neolithic age closed some 4000 years ago, he infers that the "humus-bed" has taken that time for its accumulation. The bed in question has an average thickness of 40 cm., and has accumulated therefore at the rate of 10 cm. in 1000 years. Taking this as the average rate of formation of all the underlying beds, he obtains the following results:—

1. Humus-bed = 4000 years.
2. Grey or Neolithic bed = 4000 years.
3. Breccia-bed = 8000 to 12,000 years.
4. Yellow Relic-bed = 3000 years.
5. Lower Rodent-bed = 5000 years.

The entire series of deposits, 240 to 290 cm. in thickness, thus represent a period of 24,000 to 29,000 years. Too much reliance must not be placed on these estimates, and Dr. Nüesch mentions several considerations which might reduce the period to something like 20,000 years. But they show, at least, that hundreds of thousands of years cannot have elapsed since the first appearance of Palæolithic man at the Schweizersbild.

The Palæolithic remains clearly belong to the later stages of the Old Stone Age—to that known as the "reindeer period." In the Schweizersbild deposits we find no trace of any earlier stage—the story begins abruptly with the last chapter in the history of Palæolithic times. The evidence shows conclusively that the reindeer period in Switzerland did not commence before the great glaciers of the third glacial epoch had retreated from the low grounds. As Swiss geologists recognise only three such epochs, Dr. Nüesch assigns the Schweizersbild Palæolithic beds to post-glacial times. But even in the so-called post-glacial period of the Alpine Lands, the glaciers attained a much greater development than they do now. Large terminal moraines in the valley of the Rhine show that a "post-glacial" glacier flowed as far as Chur, some 45 miles above Lake Constance. Another enormous glacier occupied the Engadine, and reached down the valley of the Inn, as far as the mouth of the Zillerthal; and similar large glaciers have left their moraines in all the main valleys of the Alps. It is probable that the palæolithic beds at Schweizersbild belong to this stage of "post-glacial" glaciation. At all events the character of the fauna of the *Lower Rodent-bed* shows that Tundra conditions of climate obtained at the time of the reindeer-hunters' appearance in the low grounds of Switzerland. The researches of Professor Nehring and others have shown that over a wide area in Central Europe, Tundra, Steppe, and Forest conditions have succeeded each other, so that the results obtained at Schweizersbild are quite in keeping with conclusions already arrived at.

The story, so far as it has now been deciphered, is sufficiently interesting. At a time when large glaciers still occupied most of the Alpine valleys, when local ice-sheets and valley-glaciers flourished in the

mountainous parts of our own islands, and a great ice-flow, derived from the snow-fields of Scandinavia, filled up the Baltic area and invaded North Germany and Denmark, the low grounds of what are now the temperate latitudes of Europe were clothed with the sparse vegetation of the Arctic Tundras. At that time those regions were denizened by Siberian lemmings, alpine hare, arctic fox, reindeer, musk-ox, and glutton. More or less abundant relics of this fauna are met with over a wide area. The lemming, for example, is now known to have ranged from Southern England and Central France, through Belgium, Switzerland, and Middle Germany, into Russian Poland and Austria—in all of which regions it was native, and not a mere immigrant. The discoveries at Schweizersbild make it quite certain that Palæolithic man was contemporaneous with this Tundra fauna. As time passed, the climate became less severe, and the arctic forms were replaced by jerboas, pouched marmot, bobac, pika, small hamster-rat, various voles, small steppe-lemming, corsac, Pallas's cat, saiga, kiang, and wild horse—a fauna which exactly recalls that of the sub-arctic Steppes of Russia and Siberia. Associated with these were many animals which are not restricted to the Steppes, such as lion, marsh-lynx, hyæna, wolf, fox, ermine, weasel, reindeer, urus, bison, ox, and musk-ox, which last was probably only a winter visitor. Prominent in this group also were mammoth and woolly rhinoceros. It was during this stage that the reindeer-hunters seem to have occupied most continuously the rock-shelters and caves of Switzerland and Western Europe. During the preceding Tundra stage, they only visited Schweizersbild occasionally—perhaps in summer-time. The climate continuing to improve, the true Steppe animals gradually departed, while the Forest forms began to take their place. It was during this transition period that the reindeer-hunter forsook Switzerland. For long before his final departure he had ceased to be a constant occupant of the Schweizersbild rock-shelter, and only visited it from time to time. As the reindeer seems to have been the mainstay of his existence, we may conjecture that it was the increasing scarcity of this animal—the migration of the herds consequent on changing climatic conditions—that led to the retreat of the old hunters. There is nothing in the evidence at Schweizersbild to suggest any hiatus or break between Palæolithic and Neolithic times. The men of the Old Stone Age disappear with the vanishing sub-arctic Steppe fauna, while the men of the New Stone Age enter on the scene with the Forest fauna. There was a gradual transition from the one stage to the other, and it is even quite possible that Neolithic man may have come in contact with some of the last representatives of the Palæolithic race. This, however, is mere conjecture.

Such is a very imperfect outline of the results obtained by Dr. Nüesch. Much interesting evidence has been necessarily passed over, but sufficient has been given to show the importance of this most recent example of cave-research. Dr. Nüesch acknowledges his indebtedness to Professor Penck for assistance in determining the precise relation of the Palæolithic deposits to the accumulations of the Glacial Period; and to Professors Th. Studer of Bern, J. Kollmann of Basel, and A. Nehring

of Berlin, for their careful examination of the organic remains. The author must be congratulated on the great success which has crowned his labours. His work has demonstrated that Tundra, Steppe, and Forest faunas have succeeded each other, thus establishing the truth of inferences already arrived at by Nehring and others. It has shown, likewise, that this faunal succession followed after the retreat of the great glaciers of the third glacial epoch, and that Palæolithic man was certainly contemporaneous in the Alpine Vorland with the Tundra and the Steppe faunas. Further, it introduces us for the first time to a lost race of Neolithic pygmies. Lastly, we have in the Schweizersbild rock-shelter the most complete section yet discovered, showing the exact succession of the several archæological epochs, the Palæolithic, Neolithic, Bronze, and Iron ages. At the Schweizersbild, probably no long interval supervened between the departure of Palæolithic and the advent of Neolithic man. It is even quite possible that the latter arrived before the last of the reindeer-hunters had vanished from Switzerland. From evidence supplied by certain Pyrenean caves, a similar inference has been drawn. But, even if it should afterwards be ascertained beyond any doubt that Palæolithic and Neolithic man came into contact here and there, it would not follow that this was general throughout Europe. We are now assured that Palæolithic man retreated from the low grounds of our continent along with the gradually retiring sub-arctic Steppe fauna, and that Neolithic man came with the succeeding Forest fauna. It seems very likely, therefore, that Neolithic man may have been in full occupation of Southern Europe while Palæolithic man was still hunting the reindeer in France and Central Europe, and it is quite possible that the two races may have touched along the margins of their respective territories. The evidence of the Pleistocene deposits of Western Europe, however, would seem to show that long before Neolithic man entered those regions, Palæolithic man had taken his departure.

ON THE RELATIVITY OF GEOGRAPHICAL ADVANTAGES.[1]

By G. G. Chisholm, M.A., B.Sc.

I have to apologise for laying before an association for the advancement of science a number of considerations that are for the most part, if not familiar, at least obvious. There is no novelty in the general proposition I desire to review. The drift of all my remarks is summed up by Professor Cunningham in his "Growth of English Industry and Commerce" in a sentence:[2] "The economic value of the physical characteristics of a country varies greatly at different times." All that I propose to do is to illustrate that general statement under different heads. Still it may not be altogether useless to do so even in an association for the advancement of science, for there are men with minds acute, penetrating, and subtle,

[1] Paper read at the Liverpool meeting of the British Association, September 1896 (extended).

[2] *Early and Middle Ages*, p. 12.

able to wind their way into the intricacies of a complex subject with admirable skill, and yet with a curious faculty of overlooking what is immediately before their eyes. Such considerations as I have to lay before you are specially apt to be forgotten in making estimates of past conditions, and still more in framing forecasts of the future.

First of all then, I would point out that the value of geographical advantages varies with the physical condition of the surface of the country. The geography of a country gets altered by the interference of man, and in other ways. That has again and again been emphasised and abundantly exemplified. Still it may be interesting on the present occasion to take Liverpool as an illustration. The importance of the natural feature to which Liverpool owes its origin, the estuary of the Mersey, is so manifest that people have often wondered why it does not seem to have been appreciated by the Romans. The explanation has been offered that this estuary did not exist in Roman, or at least throughout Roman, times, but was due to changes in the coast-line, resulting from earthquakes in that period.

But it was not merely in Roman times that Liverpool was unimportant. It was, as you may learn from your handbook, late in English history before the port was of any consequence. Now, why was this? Because, you will say, Liverpool is on the side of England turned away from the Continent. True, and that is without doubt part of the explanation of the late development of Liverpool, but it is not enough. For on the same side stands Bristol, and this, as is well known, was one of the earliest of English seaports to attain prominence. According to the estimates of population based on the subsidy roll of 1377, Bristol was at that date the third of English towns in respect of population, while Liverpool does not appear in the list at all. In the reign of Henry VII. Bristol ranked fifth among English seaports in respect of customs duties paid then, Liverpool being again absent from the list. But in those times Bristol had decisive advantages which did not belong to Liverpool. Bristol is the port of a region which has always been one of the richest, agriculturally, in England, and one to which population had also been attracted at a very early date by the working of the lead-mines of the Mendips. The physical conditions on the estuary of the Mersey were totally different. On the south side the peninsula of Wirral was a low, boggy flat "anciently," says Camden, "all forest and uncultivated, as the inhabitants relate, but disforested by Edward III.," and described as being, even in his own time (that of Queen Elizabeth), although "thick set with towns on all sides, happier in respect of the sea than the soil, the latter being not fit for corn, but the former very plenteous in fish."[1]

The region north of the estuary again was practically cut off from the rest of England, partly by the estuary itself, partly by other physical features. Liverpool was thus dependent for its growth on the resources of its own immediate neighbourhood, and these were not abundant. In this part of the country uncultivable high grounds advance comparatively

[1] *Britannia*, Gough's edition (1789), ii. p. 424.

near to the west coast. North of Bolton the width in Lancashire between the sea-coast and the land above 500 feet is mostly less than ten miles, in places only four or five miles. Moreover, of this width, the area fit for cultivation is still further reduced by the nature of the surface. On the sea-coast both north and south of the Ribble are long stretches of blown sand, to a large extent covered only with coarse grass, and utterly useless for agriculture, driving the villages more or less inland, at Formby point, the westernmost extremity of South Lancashire, about two-and-a-half miles inland. East of that again, in this latter district, there is a narrow strip covered with peat, reaching in places to a depth of 25 feet. Extensive deposits of peat occur also in the Lancashire low grounds elsewhere, as in the celebrated Chat Moss in the south of the county west of Manchester. All such areas could be made fit for cultivation only at great expense, if they could be made so at all, and to these, in considering the likelihood of Lancashire becoming well-peopled at an early date, we must add the relatively infertile soil of the coal-measures. This formation just touches Manchester, and its general southern limit lies a little to the north of that latitude. Westwards the coalfield extends to a mile or two beyond St. Helen's. West and south of this coalfield, accordingly, there is only a small area occupied by the richer soils of the New Red Sandstone periods, unobscured by peat or other later deposits of such a kind as to make the ground practically useless. And even where the soil is sufficiently good, the surface is to a large extent too flat for easy drainage, a drawback all the greater in a part of the country where the climate, in consequence of the situation and physical configuration, is exceptionally moist. One advantage Liverpool had from the first over Bristol. It was more conveniently situated than that port for trade with Ireland, and if Ireland had retained the civilisation it possessed in the sixth and seventh centuries, probably the development of the port of Liverpool and South Lancashire generally would have proceeded more rapidly than it did. As things were, the port of Liverpool did not begin to develop till after the causes that made Manchester a great centre of manufacturing industry, and inland trade had begun to operate, and hence had made South Lancashire a centre of attraction for transmarine, and even trans-oceanic commerce.[1]

Secondly, it may be pointed out that the value of geographical advantages varies with the political condition of the country to which they belong, as well as that of other countries, and, thirdly, with the state of military science.

These two heads may be illustrated by the difference in the situation of the Roman walls in Britain and that of the Anglo-Scottish boundary. The Roman walls both ran in a nearly straight line across comparatively narrow tracts of country and through fertile lowlands. Their whole purpose was to mark off and render easily defensible a frontier against barbarians. It was important therefore that the frontier should not be

[1] The nature of the causes referred to is considered in a paper which I have prepared for the *Geographical Journal* ("On the Distribution of Towns and Villages in England," Pt. II.), but which is not yet published.

unnecessarily long, and in those times that it should run through a country from which it was easy to draw supplies. These conditions were fulfilled in both the situations where the Roman walls or ramparts were erected.

The strength of the situation of the more important of the two walls, that of Hadrian, which formed the limit of Roman dominion in Britain for between two and three centuries, was already pointed out by Camden, who adds that its weakest point was discerned by the Caledonian invaders who ultimately broke through it. "It is worthy of observation," he writes, "that as the Roman prudence raised this wall in such a manner that it had within it, like a second defence, two large rivers, the Tine and the Irthing, which are but a very little way asunder; so the cunning of the barbarians first opened their principal inlet between these two rivers where they had free entrance into this province without the obstruction of any river."[1] The traditional point of this irruption is at Thirlwall, which at least from the time of Fordun is said to owe its name (from the Anglo-Saxon *thirlian*, to penetrate) to this circumstance. "Whatever truth there may be in this etymology," says Mr. Bruce, "it is certain that this is the weakest part of the wall."[2]

But when England and Scotland came to be divided, two more or less civilised powers had grown up with different centres. The centre for England was towards the south, all the more absolutely so since the ruthless harrying of the only populous region in the north, that between the Humber and the Tees, by William the Conqueror. The centre for Scotland was on the borders of the Firth of Forth, round which the bulk of the population was necessarily settled. If these two powers were to effect a final breach, it was natural that that breach should take place where the cohesion was least, or in other words where the population was least dense, and was by the nature of the surface ever bound to be so. The section across the Cheviots from the Solway to the Tweed is just that line. Petermann's map showing the distribution of population in that region in 1851, might have served almost equally well so far as the shading is concerned to represent the distribution of population in that region at any previous period after the establishment of the kingdom of Scotland, except that in earlier times a much lighter shade would have represented the basin of the Clyde. Hence it was as natural that the two kingdoms, if they were to break off at all, should break away at that line, as that an hour-glass when any transverse strain was applied should break in the middle. The boundary between England and Scotland is similar to that between Spain and Portugal, along the line of scanty population marking off on the west the more fertile and populous tracts on the lower Tagus and the lower Douro. East and west of the sheep-pastures of the Cheviots the tract of arable land between these hills and the sea is very scanty, and in the east the border is marked by a river broad enough to serve as a good line of defence. On the west the tract of arable lowlands between the Cheviots and the

[1] Camden's *Britannia*, Gough's edition, 1789, iii. p. 214.
[2] *Handbook to the Roman Wall*, 4th edition, 1895, p. 189.

Solway is even of less extent, and to make their frontier more easy of defence the English here secured for themselves the bog known as Solway Moss above the head of the Solway between the Esk and the Sark.

The natural character of this boundary, the degree to which it was determined by geographical conditions in accordance with the circumstances of the time, is shown by the manner in which it came to be established. There is no record of any formal agreement on the subject. Boundary commissioners were appointed for the purpose of adjusting the marches early in the thirteenth century, but this seems to have led to no definite result. The boundary was regarded as settled by usage.[1] This, however, does not apply to the then important town of Berwick-on-Tweed. It remained long in dispute between the two countries, and not till 1482 was it finally ceded to England.

But while it was quite natural that the boundary between England and Scotland should come to be drawn just where it was, it does not follow that it was absolutely certain from geographical conditions that any boundary should be drawn at all. It must be remembered that the kingdom of Northumbria stretched quite naturally from the Forth to the Humber. Why, therefore, should the kingdom of England not have reached to the Forth also?

In answer to this question two views are possible. In the first place, we must note that before the Norman conquest the relation of the territory between the Tweed and the Forth to England had been altered by a historical event. In 1018 the battle of Carham wrested that territory from Northumbria, so that at the time of the conquest it was not regarded as subject to the English crown. If it had been so regarded at that time, it may be conjectured, from the character of the Conqueror, that he would have been resolute in keeping it in subjection, and if he had succeeded in doing so it is not improbable that the whole of Britain would very speedily have been made one kingdom.

On the other hand, it must be remembered that it was easier for a kingdom with a capital on the Ouse than for one that necessarily had its capital far in the south to retain under its sway a population so distant and isolated as that in the basin of the Forth. It may be doubted whether the military organisation of the time was equal to such a task. Resolute as William was, it is clear that he fully appreciated the difficulties of the smaller enterprise that he had entered on. Otherwise he would not have thought it necessary to give such a severe lesson to the rebels of the north. A disposition to wanton cruelty was no part of his character, and it may be surmised that the devastation of the northern counties was prompted, not merely by the desire to strike terror, but to remove the danger of a dense and prosperous population so far from the centre of his power.

Fourthly, the value of geographical advantages depends upon the state of applied science. This also is a commonplace and need not detain us long. It is abundantly illustrated in the history of British

[1] Burton's *History of Scotland*, edition 1876, ii. p. 10.

industry, more particularly in the iron and textile branches. Notwithstanding the wealth of Great Britain both in coal and iron ore, it was only comparatively late in our history that we ceased to look to foreign countries for large quantities of our iron wares and pig-iron. Till about the middle of the eighteenth century the use of coal for the smelting of iron was practised only as a trade secret, and only gradually did its use become commoner after that. The presence of extensive woods for the supply of charcoal was looked upon as necessary for this industry, and hence the districts in which it flourished were richly wooded tracts like the Weald, the forest of Dean, and the western midlands. In the eighteenth century the smelting of iron ore for the supply of British ironworks was considered (at home) a very proper industry for the plantations on the eastern seaboard of North America, but the manufacturing of that iron a highly improper one. The first extensive ironworks in Scotland were set up (as late as 1754) amidst the forests on the sides of Loch Etive for the smelting of ore brought from England.

Down to the close of the eighteenth century the development of our textile industries depended solely on our wealth in the great raw material, wool, and the advantages of our commercial position. The marvellously rapid growth of our textile industries may be dated from the year of the erection of the first mill employing steam-power (1785, at Papplewick, near Nottingham). It was then that our coalfields began to be turned to account in a manner hitherto not dreamt of.

The precise nature of the influence here referred to is also worth noticing. When cheap power was thus added to an unrivalled commercial situation, the double advantage told, and still tells, most in the case of those commodities in which the cheapness of mechanical processes and of distribution are of most importance in determining the final cost of the article. While, therefore, British manufactures maintain a high if not the highest pitch of excellence in all branches, it is in the production of the cheaper wares that find a wide market all over the globe that this country is absolutely dominant. Even in textile industries this country has keen and in some cases victorious competitors abroad in the finer kinds of goods, those in which skill, care, and taste count for more than they do in the cheaper goods of world-wide consumption. These finer and higher-priced goods are better able to bear higher charges for transport, and even to fight against the disadvantage of lack of coal at the place of their production. The great bulk of English woollens are made in Yorkshire, but some of the finer classes of woollen goods are still able to maintain their ancient seats in the west of England. In spite of our coalfields, and in spite of our enormous home and colonial trade in raw wool, France has always been able to supply us with enormous quantities of woollen goods of high quality. In a recent consular report attention has been drawn with some surprise, and as usual some reproof, to the fact that Switzerland exports to this country about four times as much as she derives from it. To those who derive all their information as to British trade from our own blue-books the fact here mentioned may well be surprising, for the practice of referring all goods imported or exported to the country from which, or to

which they are shipped, conceals the fact that we carry on any trade with Switzerland at all. But to those who keep their eyes open, there are plenty of indications that we do carry on a large trade with that country, and when we consider the circumstances it is not really surprising that the imports and exports should bear to one another the ratio that they do. On the contrary, some such proportion may be said to be the direct result of geographical conditions. Without a seaboard and without coal Switzerland under modern conditions of industry might be looked upon as being at a hopeless disadvantage in the struggle for a place in the great markets of the world. And if Switzerland had been slothful and backward, and had not believed in education, the struggle might have been hopeless. If she was to maintain such a place for herself, it could only be by widely diffused skill in the production of commodities for which a comparatively high price could be paid. It is in that way that she has raised herself to industrial eminence. For such goods a wealthy country like England naturally forms one of the best markets. On the other hand, Switzerland is by no means a natural market for many of the characteristic and dominant products of British industry, and there are other countries much better situated than this for supplying Switzerland with such commodities as she does import.

It is little more than a hundred years since the application of inventions to the utilisation of our coalfields began to work such a tremendous change in the economic position of this country. So rapidly has the consumption of coal in consequence increased that it is natural that apprehensions should have long ago been excited in view of the ultimate exhaustion of those coalfields. But it has also to be borne in mind that the value of our geographical position, so far as it depends on coal, is also liable to be affected by other circumstances than the exhaustion of our own coalfields. It obviously becomes relatively less with the opening of coalfields elsewhere ; but perhaps a still more important consideration is that advances in the electrical transmission of power derived from falling water may greatly modify the relative advantage of the possession of coal- and water-power.

Fifthly, the value of geographical conditions varies with the density of population. A certain density, not always a high density, of population is required to utilise other geographical advantages. Of this two illustrations may be given.

Professor Thorold Rogers, in discussing the failure or alleged failure of the repeated attempts of English kings to improve the English textile industry, attributes that failure, in his usual dogmatic and decided manner, "to the unparalleled backwardness of the English intelligence."[1] Whether there is or was that "unparalleled backwardness" I cannot say, but it does not seem to me that any such assumption is necessary to account for the facts. When we hear of a textile industry, such as the manufacture of linens or woollens, being introduced from abroad, we are not to understand that such industries were not previously practised at all in England. It is to be taken for granted that linen and woollen

[1] *Economic Interpretation of History*, p. 376.

garments of some kind were made throughout the country from the Roman period downwards; but the fabrics of home manufacture were only coarse stuffs made for local use in the agricultural villages. The textile manufactures introduced from abroad were those of the finer fabrics, or, as Adam Smith puts it, manufactures for distant sale. Now, such manufactures require, in order to thrive, a considerable market, and the larger the market the more flourishing and the more highly developed are they likely to become. But the home market of England was a small one. Throughout the middle ages the population was scanty. A foreign market was therefore needed to give the necessary stimulus to the development of native manufactures. Not only that, but in order that commerce might stimulate manufactures, it was necessary that the industrial products of England should be able to compete in some way, whether in respect of quality or cheapness, with those produced elsewhere, and it was long before this condition was fulfilled. The foreign commerce of England, as was necessarily the case with a thinly peopled country on the outskirts of civilisation, was long confined to the export of raw produce in exchange for luxuries and the products of a more highly developed industry. This accounts for the fact that we read of the same industry being introduced more than once from abroad, or being developed by the settlement of foreign artisans; for even when improved manufactures were once introduced, they were apt, in consequence of the inadequate market, to languish, or at least not to keep pace with the growth of those industries in countries more favourably situated. And of all countries few were more favourably situated in the middle ages and the early modern period than Flanders and Holland, with their seaports communicating with all the world, and their magnificent navigable rivers reaching into populous regions of France and Germany; and their vicinity to England made it natural and almost inevitable that from them she should derive repeated stimuli to the growth of her own industry.

That example may serve to show the necessity for a tolerably dense population to turn to account geographical advantages. The next illustration is intended to show that in certain cases or from certain points of view a sparse population may be an advantage. If we consider external commerce as a matter of great importance, and inquire into the relative advantages of different regions for supplying distant markets with agricultural produce, then we find generally that it is the sparsely peopled parts of the world that supply the bulk of such exports. Next to the United States, among all countries for which we have statistical information, France is that which produces most wheat. But France is not a wheat-exporting country. The great wheat-exporting regions of the world are such sparsely peopled tracts as Dakota, Minnesota, and Manitoba, California, Oregon, and Washington, Cordoba, and Santa Fé. An enormously greater quantity of rice is produced in Bengal than in Burma, but it is from Burma we import it.

This, of course, is looking at a geographical advantage from a very special point of view, and it may be urged that the agricultural advantages of the regions mentioned might be even more fully turned to

account if they were applied to the support of a much denser local population, and less of the produce were left for export to distant countries. That is quite true, but it is none the less true that where a population is dependent wholly or mainly on agriculture, its density may be increased to such a pitch that all the advantages of the region disappear, unless we are to consider the mere maintenance of a vast number of people a matter greatly to be desired, in whatever state of poverty and misery the bulk of those people may exist.

The last consideration that I have to bring before you in connection with my subject is one of great importance, one that has to be taken into account to a large extent in estimating the value of geographical conditions. In the abstract of my paper I have used the expression "mental attitude" to sum up what I have in view under this head. But that summary epithet requires interpretation. It must be understood in a large sense. What I wish to include under it is anything in the ideas of a people as to government, economics, religion, or the organisation of society that has an important effect on the habits of the people.

The importance of some of these considerations does not need to be enforced. As to government, for example, it is obvious that hardly anything can be of more importance in determining the economic value of the geographical conditions of that country than the consideration whether the ruling powers do or do not make it their aim to measure out the same justice to all classes and religions. I say "make it their aim," because I am here leaving out of account any blunders of policy that may be made in carrying out that aim. Few, I should think, in this country can doubt that if such were the aim of government in Turkey, the geographical advantages of that empire would be at once enormously increased. If it were conceivable that such a change were wrought in the Turkish government, or that that government could be superseded, with the goodwill of all other countries, by some other government which made that its aim, there are parts of the Turkish Empire that are probably capable of a development, or rather revival, as rapid and extensive as any we have seen in the present century.

In our own time we have had a demonstration on a large scale of the importance of the consideration now engaging our attention by a change almost as marvellous and quite as unexpected. The case I refer to is that of Japan. Here for centuries an ancient civilisation utterly unlike that of the West resolutely kept itself as isolated as possible as regards western influences. Suddenly there was a revolution in the government, accompanied by a change in the mental attitude of the governing powers. So sudden was the change that the likelihood of its being permanent was scoffed at. And yet the scoffers have proved wrong. With deliberate forethought and perseverance Japan has entered on the path of progress as understood in Europe and the countries of European origin. She has sought for European teachers, but only to teach and introduce, with no idea of remaining for ever dependent on European tutelage. She has shown herself an apt learner, and able to dispense with European assistance in almost all branches with a celerity that has surprised every one. She has thoroughly adopted the scientific

spirit—the disposition to weigh, to count, and to measure, and to be governed in one's conclusions by the results of such observations. The result has been the rapid expansion witnessed in the last thirty years, an expansion affecting all branches of industry. Japan has found herself in the position that England was in during last century and part of the present, when manufactures, commerce, and agriculture could all grow hand in hand. Formerly this change was looked upon as an unmixed benefit to the manufacturing countries of Europe, and the only fear expressed was that it would not last. Now there is no such fear, but many are rendered anxious by the opposite dread, that the expansion may proceed to such an extent that this new rival may cut us out in all markets.

There is another eastern country in which a change in the mental attitude of the people might bring about results even more prodigious. The country I mean is China, the resources of which are very imperfectly developed under the present system, and appear to be very little known in Europe. "China," says Richthofen, "is naturally the most blest of all the countries of the earth, the home of a third part of the human race, the seat of a peculiar highly developed civilisation, and apparently inexhaustible wealth in products of the soil and intelligent human labour, a land with an inexpressibly great and important future, whose gigantic trade will become more and more the subject of rivalry among civilised nations."[1] Elsewhere[2] I have given from the same authority an account of one part of the hardly utilised wealth of China in the form of a field of the most excellent coal, not merely unparalleled but unapproached in magnitude and facility of working in any part of the known world.

What prevents these enormous resources from being turned to account by modern methods is mainly the mental attitude of the Chinese, and not merely the attitude of the government, not merely the feeling of jealousy and distrust entertained towards Europeans and their ways, and the desire to exclude so far as possible European influences, but an excessive spirit of conservatism spread through the people in consequence of the exaggerated feelings of reverence for their fathers and forefathers inculcated on them through countless generations. The feeling that what was good enough for our fathers is good enough for us is, of course, common everywhere among the ignorant and sluggish-minded, but in China that idea is fostered even among the educated and intelligent. It seems to strengthen other motives, such as self-interest and dread, which are in some cases hostile to change.

It may be that the geographical conditions that have helped to determine the course of Chinese history explain also to some extent the prevalence of this mental attitude. The Chinese entered from the north on a land cut off in a remarkable degree from all other parts of the earth, but affording great room for expansion and development within its natural confines. This development went on accordingly to a large extent uninfluenced by foreign competition, whether economic or political. It was therefore able to proceed by slow degrees, involving no observable

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[1] *China*, i. 729.

[2] *Journal of the Statistical Society*, vol. liii. pp. 584-6.

changes on ancient methods. It was unaffected by such powerful stimuli as naturally result when a people are suddenly brought face to face with new conditions. Such intercourse as was maintained with distant countries at different times mainly influenced the seaboard, and owing to the vast extent of the country could not be far-reaching in its effects. Even European influence, since it was first introduced by the Portuguese, has not penetrated far, and it must be confessed that from the first there has been much in the way in which that influence was introduced to prevent the Chinese, both as a government and as a people, from according it a welcome.

Still it is impossible to believe that the present mental attitude of the Chinese towards Europeans and their methods will be permanent. It seems to me that there are two influences constantly increasing in force tending to overcome that attitude. One is political, the other economic. The political influence is the constant advance of Russia on the north, awakening the Government to the fact that railways, however repugnant to their wishes their introduction may be, are necessary as a means of defence. This influence, as we all know, has already had its effect, although apparently too late, and hence in such a manner as rather to favour than hinder the extension of Russian ascendency.

The economic influence arises from the fact that the foreign commerce of China, though relatively small, is not without its importance, and the Chinese are finding it more and more difficult to maintain that commerce against the competition of other countries that have shown more readiness to adopt European inventions. The competition of Japan in silk seems likely to prove as serious as that of India has already become in the case of tea.

But whatever might be the immediate cause it has long been foreseen that such changes as we are now considering were in the long-run inevitable. "Although," said Sir Rutherford Alcock at a meeting of the Royal Geographical Society, "none now present might live to see it, he had no doubt that the Grand Canal would ultimately be repaired, the Yellow River would be confined within its proper limits, railroads would extend from the north to the south, coal and iron mines would be worked, and cotton mills would be established to supply their own wants without sending to Lancashire."[1] Already this anticipation is partly fulfilled, but how soon we may expect its complete fulfilment we are still unable to calculate. With respect to this question there are several considerations to be borne in mind. First there are many indications that, conservative as the Chinese are, they are not so averse to novelties when once introduced as their general habit of mind would lead one to suppose. On the same occasion as that just referred to Sir R. Alcock said that "the Chinese were very slow to move, but when they were thoroughly convinced, it was astonishing with what perseverance and tenacity they kept on the course which they considered the best for their own interests." When the first railway was laid in China, that from Shanghai to Wusung, there was no lack of passengers to ensure

[1] *Proceedings of Royal Geographical Society*, 1880, p. 165.

its financial success, and only official hostility led to its being taken up. Now that the telegraph has been extended with official approval and for government purposes to the remotest parts of the empire, the people have availed themselves of the advantages thus afforded with great readiness. "The telegraph in Yünnan," says a recent traveller, "is very largely used by the Chinese, especially by the bankers and officials. By telegraph you can remit, as I have said, through the Chinese banks, telegraphic transfers to the value of thousands of taels in single transactions."[1]

But further, there is this geographical circumstance to be considered as likely to accelerate the spread of European influences. Once an important railway is in operation in China, affecting directly a large tract of country, then the present economic equilibrium is disturbed. Other parts of China will find that they are placed at a disadvantage, and one after another will begin to clamour for what they had previously no desire for, even if they were not hostile to its introduction.

What the ultimate results of the introduction of European methods of production and transport throughout China will be it is scarcely possible to forecast. That the effects of opening up a coalfield such as I have referred to above, of connecting it by rail with the Chinese plain and its seaports, could not fail to be vast is certain, but what the precise nature of those effects would be is not so clear. But that question it is not our business to determine. We leave it to the economists. With reference to it, however, we may point out one or two considerations that belong at least in part to geography. If vast industrial communities came thereby to be created in or near the Chinese coalfields, their existence would involve a large import of agricultural commodities into those districts. This could not arise without raising the price of such commodities at least in a great part of China, and that would indirectly tend to raise other prices, which would have an important effect on the relations of China with the rest of the world. Further, the fear has been expressed that when China, with its enormous advantages in labour and natural resources, does come to be opened up, European industry will be wholly paralysed, and every European market will be flooded with the products of an industry against which it is impossible to compete. But with regard to that fear it may not be superfluous to point out that the Chinese will not under any circumstances flood any market whatever with any commodities unless they get directly or indirectly something in exchange for them. They have so much human nature in them that in the way of business they will, like the English, Dutch, Germans, or Americans, give nothing for nothing. Hence any flooding of our markets with Chinese products can take place only on condition that the Chinese take some of the products of our industry in return. What commodities we should be able to supply under the conditions we are supposing it remains to be seen. It is conceivable, though perhaps no more than conceivable, that the advantages in China for the production of all ordinary commodities might be so great that none of these could

[1] *An Australian in China*, by G. E. Morrison. London, 1895, p. 166.

be sent by us in exchange for Chinese produce. But in that case China would at least take from us the precious metals. In other words, prices in China would be rapidly levelled up, and China would then be compelled and glad to take commodities of another kind. Whatever the precise outcome may be, we may feel certain that the development of Chinese resources by modern European methods could not fail to stimulate in some way or other the industries of other parts of the world than China. It might and probably would bring about a great dislocation in the present distribution of industry, but it could not bring about stagnation.

Lastly, it may be pointed out that the effects we are now contemplating are the results of the distribution of the natural resources and population of China, and would be experienced in some form or other, whatever might be the political fortunes of the country.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Congress of Orientalists.

Dr. James Burgess, LL.D., C.I.E., F.R.S.E., has been appointed to represent the Society at the Eleventh Session of the International Congress of Orientalists, to be held at Paris from 5th to 12th September 1897.

GEOGRAPHICAL NOTES.

By Andrew J. Herbertson, F.R.S.E., F.R.G.S.

EUROPE.

The Growth of Hamburg.—The development of German industry in recent years is vividly illustrated by the rapid development of its chief port Hamburg, as shown by the figures recently quoted in *Le tour du monde* (7th August 1897). In 1882 the number of vessels entering the port from the sea was 6189, a tonnage of 3,030,990; in 1889 the figures were 8079 ships or 4,809,892 tons, and, in 1895, 9443 ships or 6, 812,394 tons—52 per cent. more vessels and 125 per cent. greater tonnage in 1895 than 1882. The river port has grown in importance also, the number of vessels increasing from 9380 in 1882 to 12,385 in 1889 and 14,135 in 1895, and the tonnage from 1,435,443 in 1882 to 2,349,527 in 1889 and 3,076,421 in 1895. The traffic is now so great that new docks are to be made.

The Greek Islands in the Ægean.—Everything Dr. Alfred Philippson writes about Greece is of interest and value to geographers, and we accordingly take the following notes from his recent communication to the Berlin Geographical Society, on the Isles of Greece in the Ægean, based on a journey made last year, in which, unfortunately, no Turkish islands were visited except Samothrace.

Physical Structure and Features.—The Ægean sea, with its innumerable islands, is the uniter rather than the separator of the Balkan and Asia Minor peninsulas. Not

only do these islands link together the mountains, plants, and animals of Europe and Asia, but for many centuries they have formed a bridge for human intercourse. The Ægean sea is shallow in the north, divided into two unequal areas by the peninsula of Chalcidice, the eastern part with the islands of Thasos and Samothrace. South of this is the north Ægean trough, over 1000 mètres deep, stretching from south-west to north-east. This connects with the middle Ægean basin by a deep opening passing between two shallow regions, that on the west a continuation of the south-east peninsula of Thessaly, with the Skopelos group or northern Sporadic archipelago, that on the east with the Dardanelles group of islands—Imbros, Lemnos, Tenedos, and Hagiostrati. The coast island of Eubœa on the west and those of Lesbos and Chios on the east border the middle Ægean basin, which deepens from 200 to 500 mètres in the north to 500 to 1000 mètres in the south, and contains some hollows deeper than 1000 mètres, while islands such as Skyros and Psara rise above the surface and other knolls approach it. South of this is a plateau, never more than 500 mètres deep, save where a channel separates it into a western and eastern part—the true limit of Europe and Asia. The Cyclades rise from the European part of the plateau, and the southern Sporades from the Asiatic part. The southern trough of the Ægean lies west and east. It is over 2000 mètres deep, and is bounded by the wreath of islands, Kythera, Krete, and Karpathos and Rhodes, south of which the sea has a depth of over 4000 mètres.

Are these three chains of islands linking Europe and Asia remains of the old mountain chains?

A mountainous land-mass joined Europe and Asia even in as recent geological times as the Pliocene, where the waters of the Ægean now lap round the islands, which are the old mountain tops not sunk beneath the waves. What was the nature of these mountains? The folded mountains of Greece, stretching eastwards, suddenly end on the western shores of the Ægean, while other folded mountains trend north and north-east in the west of Asia Minor. How were these folded mountains once joined over the region where the Ægean now is?

We know that the crystalline mountains of Thessaly bend into Chalcidice and Thrace, and that Thasos and Samothrace belong to the crystalline formations that compose the whole eastern Balkan peninsula south of the Balkan mountains.

The Cretaceous ranges in the east of Central Greece stretch into northern Eubœa, which has crystalline rocks in the south. These turn north-eastwards, so that in Skyros the boundary between the two can be traced, whence they run north and north-west, through the Skopelos islands, the cretaceous rocks preponderating. They cannot, therefore, reach Asia Minor and seem connected with Athos. In Lemnos are eastward-running ranges that have not yet been interpreted.

The Cyclades are formed of crystalline rocks, bordered by sedimentary rocks such as the famous marble of Paros, and connected with the similar crystalline formation of Eubœa and Attica. It is not yet known how far north this crystalline rock extends, but its southern boundary is against the sedimentary folded range of Amorgos, which probably is continued along the west coast of Asia Minor. The folded mountains of western Asia Minor stretching to the north and north-east are composed of crystalline Palæozoic, Cretaceous, and Eocene rocks, as far as they are known, and do not seem to be connected with the Grecian ranges except in the south, where undoubtedly the folded mountains of the Peloponnesus are connected through Krete and Rhodes with those of Asia Minor.

The landscape naturally varies with the nature of the rocks. Although seen from a height many of the Cyclades appear to have soft rounded shapes, all the islands are cut up by deep erosion valleys. Gently sloping banks, well watered and covered with trees, are found among the slatey rocks, whereas the marble rises in

steep, bare walls or stretches in barren, waterless plateaus. Most remarkable of all are the gneiss-granite regions with their rounded lakes and humps, almost plantless, and recalling the higher Alpine landscapes or those of far northern lands. Naxos is not only the largest and highest, but also the most picturesque, of all the Cyclades, owing to the variety of its formations.

Climate.—Dr. Philippson's visit was in summer, and he therefore had sunny, cloudless weather, delightful for sailing with light winds among these beautiful isles. The north wind or *meltemia*, the etesian wind of the ancients, often blows with great violence and the sea is rough, and even trees cannot grow on some exposed heights; but it also keeps the air cool. It does not blow constantly, only for a few hours, or a day at a time, interrupted by light variable winds usually from some southerly point. The winds are often gusty; but even the meltemia does little or no damage compared with the sudden and violent storms of winter, which are often accompanied by rain and fog. In these stormy months, still as in ancient times, few sailors venture out from the harbours.

Products and People. — The products and occupations differ among these Grecian isles, and the people, while all pleasant and hospitable, vary in their characteristics and possibilities. Agriculture and rearing of animals are the chief sources of wealth in the Cyclades, although some minerals are found. Every patch of ground is cultivated, if often in a somewhat rough manner, by the industrious inhabitants, who build walls where necessary to make terraces for the barley to grow on. Vine and olive flourish in the better soils, and, where water flows, irrigation canals are cut and the water often raised to them, to help to nourish the southern fruit-trees—lemon, orange, pomegranate, almond, quince, peach, apricot, walnut, cherry, apple, and pear. Between the fruit-trees, in carefully prepared beds, are tomatoes, melons, cucumbers, gourds, and all manner of vegetables and bulbous plants, and last, but not least, the potato.

The breeding of animals is by no means unimportant, the uncultivable parts of the hillsides and the fallow land being used for flocks of sheep and goats; here and there mules are bred, while, in contrast to the mainland, cattle and swine are also reared.

The different islands have their special products: thus Andros yields lemons; Tinos, marble; Keos, gall-nuts and wine, cattle and mules; Kythnos, mules; Seriphos, iron; Siphnos, pottery; Paros, wine and mules; Naxos, oil, wine, tomatoes, potatoes, etc., and emery; Milos, millstones and sulphur; Santorin, wine and pumice; Amorgos, oil. The poorest islands are Ios, Sikinos, and Pholegandros.

There is little admixture of Albanian blood among the inhabitants of the Cyclades, except in the north of Andros, and still less of Slavonic. The centuries of Venetian supremacy have left their traces on the people, however, especially in Syra, Tinos, Naxos, and Santorin, where many Italian names can be noticed, and where many people are Roman Catholics. The Greek islanders are a powerful race, stouter and softer than the mainlanders, and both men and women are often of remarkable beauty. They are diligent, cheerful, peaceable, and hospitable.

The inhabitants of the Cyclades are not a seafaring folk as a rule, and most are as confirmed land rats, in spite of the smallness of the islands, as some of the mountaineers of inner Greece. Syra, one of the smallest and most unfruitful islands, is the great commercial and shipping centre of the Ægean, and has by far the largest town, with a population of 30,000, no other in the archipelago having more than 4000. Syra was the harbour of refuge of many Chiotes and Psariotes after Greece attained its independence, and it is since then that Syra has developed as a port.

Skyros, owing to the prevalence of limestone, is not a fertile island, and has relatively few people who rear animals. Although there is a good harbour there is only one sailing boat belonging to the island. The 3200 inhabitants live together in *one* town. This is also characteristic of the other Grecian islands, all the people living in large villages, not in scattered hamlets.

Skiathos and Skopelos have rounded hills and slopes with many springs, with fields of grain and olive groves, and fruit gardens on the small alluvial plains. But here, too, the keeping of animals, especially goats, is very important.

Limestone and, consequently, animal rearing predominate, and the population is thinner the farther north we go. All the islands are or recently were covered with pine woods, which yield wood for building sailing ships carried on at Skiathos and Skopelos. These two islands are the homes of sailors who can be found all over the world. They are quite different from the Cycladians—energetic, enterprising, and smart.

The forests in the other islands of the group have been cut down and burnt by the goat-herds, with the resulting impoverishment of the land, which is inevitable in these regions. This has been the economic ruin of many other Mediterranean lands.

ASIA.

The Island of Hainan.—In the February number of the *Magazine* we called attention to Mr. Madrolle's travels in Hainan, a full account of which has now appeared in the *Bulletin de la Société de Géographie Commerciale de Paris* (xix., pp. 347-367).

The first European to visit Hainan was James Purefoy, who was wrecked there at the beginning of the century and hospitably received by the inhabitants, of whom he wrote most favourable descriptions. Father Mailfait, a Frenchman, was the first to describe the aborigines of the interior, but he died on the island the same year he landed on it—1850. Protestant missionaries are settled in Hainan, and recently the Rev. Mr. Jeremiassen has traversed the island and made interesting linguistic studies.

Mr. Madrolle landed at Hoi-hou, or Hai-kao, the harbour of the Kiung-chou, the only treaty port. Thence he proceeded south-east to No-doa, where American missionaries have a station, and traversed the mountainous regions in the centre of the island. He says little, however, about the physical geography of the island.

Hainan is the granary of Hong-kong, to which most of its products are sent—including pork, sugar, poultry, eggs, honey, and other edibles, in addition to hides, fine cloth, areca nut, hemp, and other substances of less value. The rice crops of the island are not always successful, and rice is regularly imported from Tongking, Cochin China, or Canton. Yünnan is beginning to send opium as well as India. Indian cottons are more and more imported, and petroleum from Sumatra is slowly ousting that from America and the Caucasus, and is used by the natives instead of that of sesame, while cheap Japanese matches inundate Hainan as they do other Eastern markets.

The Chinese vessels carry on trade with many ports, but Hoi-hou is the only one open to foreign ships. British ships used to be most numerous, then German ones; now the Danish vessels predominate, and the number of French ones is growing owing to the nearness of Tongking.

The Chinese occupy only the periphery of the island, whose mountainous interior is inhabited by two different races—the Sai, Loi or Lai, who still retain their independence and language, and the milder Miu, known on the continent as the Miao-tse, more or less assimilated with the Chinese. The Chinese, who first

invaded the island two thousand years ago, are not the only immigrants, for Malays have come from the south, and Annamites from the west, so that in addition to different Chinese dialects, there are at least six other languages spoken on the island. Mr. Madrolle estimates the number of inhabitants at 1,800,000. He gives a brief bibliography at the end of his article, which will be of use to those who wish to learn more of the little that is known about this island.

AFRICA.

Suez Canal Traffic, 1896.—The following table shows the Suez Canal traffic returns for 1896 and comparisons with 1895, as given in the *Revue Scientifique* :—

State.	Ships.	Net Tonnage.	Per Cent. of Tonnage.	Tonnage. Increase + or Decrease − compared with 1895.
British,	2,162	5,817,768	68	245,000
German,	322	806,279	9·4	+113,000
French,	218	532,273	6·2	−141,000
Italian,	230	392,693	4·6	+246,000
Dutch,	200	380,404	4·4	+15,000
Spanish,	62	182,315	2·1	+87,000
Austro-Hungarian,	71	158,300	1·8	−8,000
Russian,	47	134,300	1·6	+47,000
Norse,	39	73,840	0·9	−35,000
Ottoman,	37	41,289		+6,000
Japanese,	10	30,553		+28,000
Portuguese,	7	5,993		+2,500
Egyptian,	2	2,274		0
Belgian,	1	1,891		+1,891
Sarawak,	1	103		

The great increases in the Italian and Spanish figures are accounted for by the troubles in Abyssinia and the Philippines, which have necessitated the transport of many troops ; whereas the decrease in the French figures is due to the abnormal number of ships and men sent through the canal to Madagascar. The fall in the proportion of British tonnage by nearly 4 per cent., from about 72 to 68 per cent. of the total, is not entirely explained by these causes, as it has fallen over 4 per cent. in actual tonnage ; whereas the tonnage of Germany has increased 14 per cent., of Russia 35 per cent., and of Japan 93 per cent. This emphatic testimony to the growing traffic of German and Russian ships with the East is hardly less noteworthy than the appearance of Japan as a shipping nation, with regular services to and from Europe. The number of large vessels is increasing.

The number of passengers who passed through the canal in 1896 was 308,241 compared with 216,940 in 1895, but the difference is almost entirely due to the fact that 90,000 more soldiers passed through the canal in 1896 than in 1895. In 1896 over 74,000 Italians, 27,000 Spanish, 27,000 British, 22,500 Turkish, 20,000 French, 11,700 Russian, and 10,300 German troops were conveyed by the Suez route.

Lake Leopold II.—Recent investigations of this lake, which was discovered by Mr. Stanley in April 1882, show that its form more nearly approaches that first given by its discoverer, and is smaller than that now usually shown on our maps. In the *Mouvement Géographique* for July 18th, a sketch-map of the lake by Mr. Hector Cambier is published, with some notes on the surrounding region. The surface of

the land is so flat that no water parting can be traced, and during the rains large tracts are flooded, rendering land traffic difficult, but producing excellent conditions for paddy. In spite of the dampness the region is said to be one of the least unhealthy in the Congo basin, probably owing to its sandy soil.

The lake is very shallow and difficult to navigate. Its waters are coffee-coloured, and, after they leave the lake, they flow parallel to the clear waters of the Lukenye for some miles before the two mix and the coloured waters affect the whole. The river below the affluent of the lake is called the Mfini. The country is covered with typical dense forests in which indiarubber, copal, and other resins are found; and Maleguetta pepper is cultivated by the natives.

The region round the lake is densely peopled. The Tomba are the chief stock, bordered on the north by the Tollos. The Tomba are chocolate-coloured men of fair height, with round heads, medium brows, dull eyes, and small noses, and two concentric circles are tattooed on the temples. Hunters and fishers, armed with bows and arrows, they are fierce and yet timid, so that their defensive attitudes in the presence of strangers are apt to be misinterpreted as aggressive. They catch fish in a conical basket with a cover which closes by a simple spring when the fish touches the bait. They hunt with arrows poisoned with the juices of two euphorbias and an amaryllid, which, however, do not affect the digestive tube, and so they can eat the animals they kill. A great mass of wood with a strong lance in it is suspended thirty to forty feet above the ground between two trees, so that when an elephant passes and breaks the stem of the creeper stretched between the trees it releases this weapon, which falls and mortally wounds the huge beast. The Tomba weave palm fibres, and are skilled founders of iron brought from the Gundo country. A red dye and pottery are made by the women. The Tomba are cannibals, but rarely eat any except war prisoners. Naturally they are fetichistic. Circumcision and tattooing are carried out when children are three years old.

Population of Algeria.—We take the following figures, based on the census of 4th March 1896, from the *Revue Scientifique* for 19th June 1897:—

	1891.	1896.	Increase or Decrease.
French,	267,672*	345,337†	+38,665*
Spanish,	151,859	158,071	+6,212
Italian,	39,161	35,539	−3,622
Anglo-Maltese,	15,675	12,815	−2,860
German,	3,189	3,319	+130
Other foreigners,	10,036†	10,183†	+147
Mussulmans (French subjects),	3,559,687†	3,757,917†	+198,230
Tunisians and Maroccains,	17,376	17,832	+456
Indigenous Jews,	47,459	53,116	+5,657
	4,112,114	4,394,129†	+243,015

* Without army. † With army.

The army amounts to 52,000, of whom 39,000 are French, 3000 are other Europeans, and 10,000 are natives. The French population has been increasing at the rate of over 7600 per annum; about 5000 of that number being due to immigration, largely of functionaries unfortunately, 1300 to naturalisation, and 1200 to 1300 to the excess of births over deaths. The proportion of the French population compared with the other European residents is steadily increasing. In 1876 the French numbered about 300 more than the other Europeans. In 1896

the number of French had doubled, excluding the army, and despite the increase of foreigners the French outnumbered them by 86,000. The natives are increasing even more rapidly than the French. Perhaps the most interesting fact is that here, as in Canada, the birth-rate among French families is much higher than in France, where the economic conditions are less favourable.

Native Copper at Katanga.—Commander Brasseur describes in *Le Mouvement Géographique* (July 25) the method used by the natives in extracting and preparing copper in Katanga, which they keep secret from all but the initiated workers and their wives. The malachite is quarried in roughly rectangular excavations and even rudimentary galleries, by means of hoes and light axes made of iron in the Ballachi country. It is then exposed to the air, and carried in earthenware pots to another place, where it is melted by primitive fires and blasts. It is melted a second time in smaller vessels and then poured into a cross-shaped clay mould. The operations are strictly secret, and even the wives of the miners are kept in a separate encampment and not permitted to have intercourse with them lest the smelting should be harmed in any way.

Madagascar.—The troubles of the French in Madagascar are benefiting geographers, for each expedition brings back new information about the country. Mr. Émile Gautier, writing at the beginning of this year, summarises recent results in a letter published in the May number of the *Annales de Géographie*.

One of the most pressing needs of the French is rapid communication from the coast to the capital. At present the cost of transport is £80 a ton, for porters demand three times what they used to do, and the mule path is impassable at places; while the price of native produce has increased fourfold. Mr. Gautier thinks Tamatave likely to be the terminus of the road and future railway, because of its better harbour and greater development than the nearer port of Andovoranto. An easier if longer route than the straight track followed by the natives should be followed, for the valleys of the tributaries of the Ikopa, Mangoro, and Ivolina are separated by no great heights. On the west side of the island the river Manambolo has been found navigable to Ankavandra.

Gold may be an important product in the island, but at present mining is at the "placer" period, and prospectors for the Transvaal conglomerate have hitherto been unsuccessful. A search for the reported bitumen of Ambohitsalika was unsuccessful, and it cannot be of much commercial value. The coal found at Ambavatovy is now believed to be a cretaceous or even tertiary lignite and of little use.

The sedimentary rocks in the west consist of red sandstone and limestone in almost horizontal layers, except where the sandstone comes in contact with the gneiss.

The geologists confirm the map of Mr. Baron (*Quarterly Journal Geological Society*, 1895), but point out that the parallel chains of gneiss and red sandstone are more marked than that map indicates. The red sandstone has no fossils, save some silicified wood, but near the top, at the base of the limestone, especially in the layers of limestone interstratified with the sandstone, some are found of Jurassic age, while those of the limestone are cretaceous and tertiary.

AMERICA.

German Colonisation in Brazil.—Several Hamburg merchants and the North German Lloyd and the Hamburg and South American Steamship Company have floated a company with a capital of £75,000 to promote German colonisation on 650,000 hectares (1,600,000 acres) recently acquired by them in Brazil. The com-

panies agree to carry emigrants to Brazil for 10s., and they hope to transport 1000 people during the first year and 500 each succeeding year for some time to come.

The *Kolonisation Gesellschaft* has received a concession from the Brazilian government to build a railway from San Francisco Bay by Joinville and Blumenau to Desterro.—*Le Mouvement Géographique*, 6th June 1897.

Expedition to the Rio Aisen.—Our corresponding member, Dr. Hans Steffen, has sent us the following summary of the results of his last expedition into the Chilean Andes, which he has communicated to a Puerto Montt newspaper, and holds out the hope of giving us a fuller account of his work at no distant date.

The party, which consisted of Dr. Steffen as leader, Drs. Fischer and Dusen, Messrs. Horn and von Schellendorff, sailed from Puerto Montt on the 29th December 1896. On the 2nd of January they began to ascend the river Aisen, which winds across wide alluvial llanos covered with very dense vegetation. It is to be noted, however, that the woods in this latitude (about 45° S.) are not so dense as those on the rivers Palena, Puelo, and others of Chilean Patagonia.

On the 11th they reached the island of Flores, so called by Captain Simpson, the first explorer of the Aisen. The river is formed by two branches, one coming from the north-east, the other straight from the east, and meeting at this point. Here the party divided into two groups: Drs. Steffen and Horn followed the completely unexplored river from the north-east, while the others, under Dr. Fischer, travelled up the river from the east, part of which had been visited by Captain Simpson. The programme was that the two parties should meet in Argentina, and afterwards return by the pampas towards the north.

The rest of January and all February were devoted to the exploration of the two rivers, and both parties managed to cross the Cordilleras, and to study the water-parting with sufficient accuracy to form the basis for the future boundary determinations in these regions.

The first party proved that the northern branch of the Aisen rises in an immense glacier, at a height which ought to be the divide between the basin of the Aisen and that of Lakes La Plata and Fontana, and then turned to the east, crossing hilly ground and beautiful valleys with a number of small lagoons, to the Patagonian plain, suffering considerably from scarcity of food on the way. On March 23rd they encountered a band of Indians ready to conduct a cavalcade across the pampas, on the banks of the Sgenuer which flows from Lake Fontana.

The second party was not so long in the Cordilleras, and as early as March 6th they met an Argentine commission and several individuals who had settled on the banks of the Nyribao, the chief tributary of the northern branch of the Chilean Aisen. They then journeyed to the north, making several detours towards the Cordilleras to study the watershed between the Argentine Chubut and the rivers Palena and Corcovado which flow into the Pacific; while the first party made a section of the divide between the rivers Teca and Corintos to visit the gold mines in the Corintos valley.

The members of both parties met at Lake Nahuelhuapi, except Dr. Dusen, who had previously returned, and started on April 23rd for the Perez Rosales Pass, and after hardships caused by bad weather they reached Puerto Montt on May 2nd.

Chile possesses in the woods and valleys in the heart of the Cordilleras immense riches hitherto almost unknown; and it is highly desirable that roads should be made joining them to inhabited regions. In the valley of the Aisen, however, notwithstanding the existence of podocarpus and cypress, chiefly along the banks of the north-eastern branch of the stream, no timbers have been found such as the larch and the cedar, which give an interest to the valleys farther north.

Next summer the Argentine-Chilean Boundary Commission will be at work in the region explored by Dr. Steffen, and three new sub-commissions of engineers will be formed for the purpose of fixing the boundary there. It is probable that the inapplicability of the present boundary agreement to this region may lead to differences of opinion among the joint commissioners, and necessitate the matter being referred to arbitration, the Queen being the arbiter mentioned in the treaty.

AUSTRALASIA.

The Huon Gulf, New Guinea, is one of the least-known regions in German New Guinea; but, as it may afford the easiest access to the recently discovered gold regions, Captain Rudiger has given a description of it in the *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* (xxiv., p. 280-295). Navigation along the coast is not dangerous, but there are few good anchorages in the numerous very deep bays which indent the coast. The Markham, Hercules, Clyde, and other rivers send much dirty yellow water far out to sea.

The Preussen Rhede, near the mouth of the Markham river, is probably the best anchorage, and here a short channel leads to a lagoon which the Germans call the Herzog See. Many islands dot the surface of the lake, whose shores are covered with mangrove-trees, and whose inhabitants live by fishing. North of Hercules Bay, at Adolf Hafen, Captain Rudiger discovered another large lagoon, shallow in the centre but deeper in the bays, which the German New Guinea Company have christened Martha See.

No regular meteorological observations have been made, but the general characteristics of eastern New Guinea hold good—the south-east monsoon blows from April to November, and on the north coast the north-west monsoon the rest of the year; on the south coast variable northerly winds. June to September are the rainy months in the north, while the rain falls during the summer in British New Guinea.

The discovery of gold in the interior has led several prospectors from Australia to penetrate the country from the south. It seems doubtful whether the gold is found in British or German territory, as the boundary has not yet been marked out on the spot.

POLAR REGIONS.

It is reported from Hammerfest that the Jackson-Harmsworth expedition left Franz-Josef Land on August 15th to return home.

A Buda-Pesth newspaper to-day (August 21) publishes a telegram from Gjaervaer, stating that the expedition under Captain Baade has safely returned from Ice Sea. Progress was impossible beyond 80° 40′ north latitude, owing to obstructing masses of ice. The expedition includes the following Austro-Hungarian members:—Edelsheim, Gzulai, Professor Jirusch, and Hoehnel, and others.—*Reuter.*

Belgian Antarctic Expedition.—The Belgian Parliament has passed a supplementary vote of 60,000 francs, and the Antwerp municipality has doubled its original subscription, for the Belgian Antarctic expedition. The *Belgica* sailed from Antwerp on August 23rd. The plan of exploration proposed is to proceed to the seas south of America, and work there in the coming summer, and then a year later to examine Victoria Land. Mr. de Gerlache is leader, and Lieutenant Lecointe of the French navy is second in command; Lieutenant Danco will undertake magnetic observations; Mr. Artoski, a Pole, meteorological and oceanographical work; and the Romanian, Dr. Racovitza, will be charged with botanical and zoological research. Messrs. Meelaerts and Amundsen, the latter a Norwegian, are the other officers; and the full complement of 22 men is made up

mainly of Amundsen's compatriots. The *Belgica* seems to be admirably fitted out, the sounding, dredging, and deep-sea fishing apparatus being copied from those in the Prince of Monaco's scientific yacht *Princesse-Alice*. Most of these particulars have been obtained from *Le Tour du Monde* for August 21st.

The *Fram* is to go to Arctic Seas again next summer with its old commander, Captain Sverdrup. It is proposed that the *Fram* should sail through Smith Sound to inspect the "paleocrystic" ice, and return by the north-east of Greenland—thus circumnavigating the great island.

GENERAL.

Weather Relations between the Cape and India.—The winter rains of the Cape peninsula usually set in towards the end of May, just when the monsoon breaks in India. This year they began on the 25th May, but soon ceased, as the pressure rose all over Cape Colony, and the high pressure conditions covered a much wider area than is usual in June, causing abnormal weather all round the coast. We have received a newspaper article on this anticyclone by Mr. Hutchins, the distinguished head of the Forestry Department at the Cape, who is also an able meteorologist. It will be remembered that last year he suggested to the Indian Weather Department that the Indian rains would probably be abnormally small, owing to the failure of the south-east trade-winds at the Cape in 1895-96, and unfortunately his prophecy turned out to be only too accurate. In this article he again notes the connection between the weather at the Cape and India. While the usually marked high pressure area extended over Cape Colony, there was an area over the Bay of Bengal experiencing abnormally low pressures. The great earthquake which did so much damage in India occurred during this unusually low pressure, and it is at least a significant coincidence that shortly after this the Cape anticyclone broke up, and the normal rains set in at the Cape peninsula. The question of the relationship of what are termed centres of action of the atmosphere is now engaging the attention of meteorologists, and seems to be one whose solution will have much practical importance. Should a study of the Cape weather permit the more accurate forecasting of the Indian rains, the boon to the Empire would be very great.

MISCELLANEOUS.

Nearly 805,100 ounces of gold were obtained in Victoria in 1896.

In July a beginning was made of the line which is to join Bahia Blanca to Ruffino in Argentina, and open up a country which is good both for grazing and grain raising.

According to *Engineering* a Japanese company has been formed to construct a canal 22 miles long from Tsuruga, on the Sea of Japan, to Lake Biwa, whence a second canal will be cut to the Usikawa, and thus reach the Pacific at Osaka.

The new expedition up the Nile is pushing southwards. The desert railway is being laid with great rapidity, and now (August 23rd) stretches 137 miles from Wadi Halfa. The Nile is rising, and, according to indications at Meroé, will probably be above the average height in Egypt this season.

This year's report of the British Association's Committee on the Climatology of Africa is taken up with the rainfall of Nyasaland, and the discussion of two years' complete observations by Mr. Moir at Lauderdale, Nyasaland, and the

Scottish missionaries at Kibwezi, British East Africa, together with those of variation of level of the Victoria Nyanza.

The importance of adequately equipped and properly supervised meteorological services in our colonies, not only for the progress of scientific meteorology and climatology, but also for the practical advantage of the colonies themselves, is coming to be more and more recognised. The secretaryship to the Meteorological Commission of the Cape of Good Hope recently became vacant, and we are glad to learn that the Commission have appointed a competent meteorologist to the post, in the person of Mr. Charles Stewart, B.Sc., who has been trained at the Ben Nevis Observatories and the Scottish Meteorological Office in Edinburgh. Mr. Stewart sailed for Cape Town on July 9th.

The Queensland Post and Telegraph Department has sanctioned the extension of the Queensland weather charts, prepared and published by the Meteorological Department, to the region between 40° N. and 55° S. lat., and between 30° E. and 130° W. long., *i.e.* to all the Indian and most of the Pacific Ocean west and south of San Francisco. Ship logs and other meteorological information about this vast area should be sent to Mr. Clement L. Wragge, Government Meteorologist, Brisbane.

The Production of Copper in 1895-1896.

	1895.		1896.	
	Tons.	Per Cent.	Tons.	Per Cent.
United States	172,300	51·6	208,893	54·7
Spain and Portugal	54,950	16·5	53,375	14·3
Chile	22,075	6·6	23,500	6·3
Japan	18,430	5·5	21,000	5·6
Germany	16,555	4·9	20,065	5·3
Mexico	11,670	3·5	11,150	3·0
Australia	10,000	3·0	11,000	2·9
South Africa	7,080	2·1	7,450	2·0
Other Countries	21,275	6·3	21,825	5·9
Total	334,335		378,258	

In 1882 the total was 258,036 tons; in 1892, 303,534.—*Handel's Museum.*

The County Council of Aberdeenshire have issued an instructive report of "a tour of inspection and course of instruction for fishermen from the county," carried out in the last two months of 1896. Under the guidance of Mr. R. Turnbull, F.S.A., Lecturer in Botany and Biology, School of Medicine, Edinburgh, a number of picked fishermen were taken to the chief fishing centres on the east and south coasts of Britain, and to the Marine Biological Stations of the Scottish Fishery Board at Dunbar, of the Essex County Council at Brightlingsea, and of the Marine Biological Association at Plymouth. Much information was gained as to fishing gear and methods adopted in the different regions. Some of the tackle and processes employed were improvements on those of Aberdeen fishermen, while others were not. A method of treating nets with creosote used by Cornish fishermen, if adopted in Aberdeenshire, will save the fishermen many hundreds of pounds every year, and amply justify the expenditure of the County Council on this tour of inspection. Apart from this immediate and obvious economic gain, innumerable hints were obtained at the different places visited which, if properly applied, should result in considerable improvements in fishing in Aberdeenshire.

NEW BOOKS.

Impressions of Turkey during Twelve Years' Wanderings. By Wm. Ramsay, D.C.L., LL.D. London: Hodder and Stoughton, 1897. Pp. xii + 296. *Price* 6*s.*

In this readable and racy little volume we have Professor Ramsay no longer as the distant and eminent "authority" on Eastern geography and archæology, as historian sacred and profane, but as the keen and kindly, thoughtful and amused rambler in the East, full of personal experience and anecdote as well as of explanation and suggestion. Though our writer, as it were, pushes back his professorial chair and talks at ease, the book is not superficial, though its bright and conversational style makes such easy reading that some may fail to realise the breadth and grasp of knowledge, and miss the many weighed and weighty passages of criticism and counsel.

The author's method is still professorial in the best sense—that is, educative; it is simply "to take the reader into the heart of Turkey and let him look for himself, explaining my own impressions about the facts which he sees."

Under this guidance, then, the reader enters a Turkish village of Central Anatolia, and learns to know and understand, to appreciate and even to amuse its simple folk, before he thinks of exploring or excavating with their aid. Their open hospitality, their childlike simplicity, their "watch-dog faithfulness," soon make them our friends; and then, and only then, it is time to discuss and account for their individual and general weaknesses, or compare them with the other (similarly studied) races. Thus a great factor of the decadence of Turkey is summarised with a single paragraph:—

"In one respect a strong contrast between the average Turkish and Greek villages impressed me. In Turkish villages the women, so far as I can judge from sight and report, are feebler and poorer in both physique and mind (owing to their hard lot in childhood); whereas the Greek women struck me as being better and morally higher than the men, physically good and intellectually well developed. Therein lies the future of the two races. In the one case you have a rich soil from which future generations acquire strength and moral vigour: in the other, a stunted and impoverished motherhood produces a poor and diminishing people. In the condition of the Turkish women lies the reason for the steady degeneration of the Turkish people" (p. 49).

Continuing the method of regional survey, we accompany an archæological excursion into Phrygia out and home, sharing the scenes and their interpretations, and notice how small incidents may illuminate national character. Then comes a chapter on the Mohammedan races of Asia Minor—races like superposed or unconformable strata rich in fossils. Turks and Turkmen, Yuruks and Avshahrs, Circassians and Kurds, pass in rapid survey before us, and help us to realise more of the continuity of past and present, and to see with concrete historic parallelism how at the present day the central movement in Asia Minor is what it has always been—"a conflict between the Eastern and Western spirit." The present Turkish view of this conflict is outlined, and then follows a sketch of the personality and policy of the present Sultan, an outline of "the organised revival of Orientalism by this modern Mithridates." This of course leads to a review of contemporary European politics in relation to Turkey, well worth wide attention, although this is not the place to summarise it; an interpretation of Turkish government and officials; and finally, several useful chapters on the Armenian Question.

As is the case with the races previously dealt with, the Armenians are described

and criticised with a truthful discrimination which frankly recognises and historically explains their defects, which no less frankly recognises and explains their good qualities and their higher promise and capacity of improvement, shown when anything like a chance of better conditions is given them, thus vigorously demolishing the interpretations of Armenian and Turkish types and relations lately presented by Mr. Hogarth in his *Wandering Scholar in the Levant*.

The Greeks in Asiatic Turkey are next studied and compared with the Turk, and then comes the main conclusion of the book: "that a union of their qualities is needed to make a strong and self-sufficing nation. Each seems to possess some good qualities that are lacking in the other. Take the best among each race and compare them. The Greek can be brave, but you can never trust him to die at his post or to fight to the bitter end in the face of discouragement and despair. The Turk will maintain his trust till he is cut to pieces and will stand at his post till he falls; but he is devoid of resource and ingenuity, and is hardly ever able to command or to organise the strength of a number of other men, which the Greek can do. In every department of practical life you want to have men of both races on your staff; and it has always seemed to me that the Turks and the Greeks will united make a happier country than either race could by itself" (p. 257).

Here really the volume ends: the two final chapters, "Turkey's Debt to her Predecessors in Asia Minor" and "Tips to Archæological Travellers," being far more of the nature of an appendix: as they stand, they weaken the unity of the book and the force of its conclusions.

We cannot lay down this fascinating work without contrasting its sympathetic yet keen and all-round criticism with the geographical, historical, and economic misinterpretations with which party politics and journalism so often obscure the Eastern Question. One thinks of what use the book might have had two or three years ago; and one all the more deplores its late appearance, when the mischief is already done, the sides so much taken, and the main interest of the world in general, and of our country in particular, is passing to other fields. Thus life ever outruns science, science but gleaning after life; and thus, literally, the people ever perish for lack of knowledge.

The volume, however, should still be read by every one interested in the East.

A Ride through Western Asia. By Clive Bigham. London: Macmillan and Co., 1897. Pp. 284. *Price* 8*s.* 6*d. net.*

This is a travelling age, and of the making of books of travel there is no end. First we have the Learned Traveller, like the late Sir Richard Burton, who burdens his pack animals with works of reference, writes in the tent, and treats even the most casual subjects microscopically. Then there is the Theoretic Traveller, like Palgrave, who draws upon his imagination from the day of quitting Europe, and ultimately sits down to compile a monumental book in London or Berlin, beside great libraries, and with the assistance of others. And, to name no more, there is the Travelling Sponge, passing rapidly over vast surfaces, mopping up material of the most mixed description, and bound to be back at the starting-point for the purpose of discharging the contents within a given period. With regard to the author of the work before us, were it necessary to place him in a category, it should be in that of the Clear-the-way Traveller. Some would define an "obstacle" as that which stops us; but for Mr. Clive Bigham, formerly of the Grenadier Guards—in what rank or capacity is left unstated—and more recently an Honorary Attaché to our Embassy at St. Petersburg, an "obstacle" merely is that which has to be removed, got round, or overleaped. The unpretending volume in which

Mr. Bigham narrates his experiences is remarkable for the force and clearness of its literary style, the beauty of its thirty-four illustrations, and the great breadth of country over which it extends. It contains but 269 pages, not counting a glossary of words, four useful maps, and an index. Nevertheless, it embodies, in only too slight a form, the results of eleven months of going to and fro in Asia, in which time "8217 miles" were covered. Of the five Parts into which the book is divided, Part i. deals with Asia Minor; Part ii. with Persia, north to south; Part iii. with Turkish Arabia; Part iv. with Persia, west to east; and Part v. with Central Asia. A good way of showing further the comprehensiveness of this programme would be to cite the headings of the chapters into which each Part is subdivided; but our limits forbid. Constantinople formed the author's starting-point. It was there that he managed to obtain the "tezkerah," or Turkish passport, which, backed by his own personal qualities, and by his mastery of the art of "palm-oiling," proved the "open sesame" to so many new countries: beginning with "the very centre of Armenia"—reached in less than a month from London—and extending to parts of such surpassing interest as the Caspian littoral, Teheran, Ispahan, Persepolis, the Kârûn and the Tigris rivers, the seats and centres of the Kurds, Russian Turkistan, Samarkand, and Bokhâra, so redolent of the poetry of Hafiz, Chinese Kashgaria, and, lastly, the land of the Trans-Siberian railway, by means of which, "when the whole railway is finished, which it should be by the end of the century, one will be able to go by train from St. Petersburg to Vladivostock, or wherever the Pacific terminus may be placed, in eleven days, traversing a distance of 6000 miles."

In connection with the "luck," as he modestly calls it, which attended this traveller, notwithstanding his preference for the most "hopeless" and "impossible" routes, and his habitual deafness to all "persuasions to wait a little longer," because of "stringent orders," "disturbances," "reports that cholera was raging," and so forth, perhaps it is worth noticing that when he set out he knew very little of Turkish, Arabic, or Persian. To Lord Clive, the conqueror of Bengal, is ascribed the saying, that if he had understood Hindustani, he would have been so befooled by the natives of the country as to be practically helpless. Sympathisers with this view may adduce in support of it the example of Mr. Bigham. But for our part, neither can we forget Bacon's apothegm, "*He that travaileth into a country before he hath some entrance into the language, goeth to school, and not to travaille*," nor can we dismiss Mr. Bigham's pages without observing that, successful as his journey was, his description of it would have been more trustworthy had he been in certain respects better equipped. How strange, for example, is his error in informing his readers that the *killik* (commonly pronounced *killij*), or raft, used on the Tigris is supported on pigskins! Considering how tabooed is the pig and all its products in Moslem countries, we should not have thought it possible for any such representation to be either imagined or accepted, even by the most inexperienced traveller. Again, the reference at p. 175 to "the difference between the two sects of Sunnis and Shiahs," is too defective to amount to anything more than a waste of valuable space. The title of the book can lead no one to resort to it for information on one of the deepest and most comprehensive topics of Islamic history. Why, then should a writer, who can spare but a few brief pages for "Transcaspia and Bokhara," interrupt his "Ride" for the sake of subjects on which he has nothing new to communicate—nay, of which his knowledge is hardly abreast of that of many of his readers? To give an example: if the author, when he visited Karbalâ in Turkish Arabia, made the discovery that "here are buried Husein and Hassan, the two sainted sons of Ali," he should, in regard to the latter, have cited his authority, it being among the facts of history that while Ali's younger son Husain ("the lesser

Hasan") perished in the Karbalá butchery, his elder brother, the titular Caliph Hasan, died, or rather was poisoned, at Medina, several years before the plain beside the Euphrates first received the dust of "martyrs." Marks of carelessness like those now noticed lessen the value of a book of travels. The best advice which we can offer to the author of the "Ride" is, that in future editions he should discard all mere deadweight, and, restricting himself to scenes and incidents which he has witnessed, carefully verify his observations. In the category of deadweight may safely be included all his etymological material. His derivation of the name Baghdad, for instance, is too puerile to bear repetition. Mercifully the reader is spared a biography of the eponymous, and of course absolutely apocryphal, "David," whom it pleases this writer to associate, for the first time so far as we know, with the city of Hárúnu 'r rashid, or "Aaron the Straight." One who can travel and write to such good purpose as the author of this fascinating volume, ought to be proof against the temptation of addressing himself without due preparation to the tasks of the philologist.

Indian Sketches and Rambles. By J. Bowles Daly, LL.D. Calcutta: Patrick Press, 1896. Pp. vi + 220. *Price* 2*s.*

This little book consists of a collection of articles most of which have appeared previously in the Indian Press. The greater part of them relate to India, but some have no connection with that country. The author was Professor of English Literature in the Metropolitan College, Calcutta. His paper on *The Cram System* is decidedly humorous, but his knowledge of the country generally, gained during a hasty tour, is obviously superficial, and his estimates of what he saw are often inaccurate. Speaking of the great grain-yielding districts of the Punjab, he doubts if any agricultural or industrial skill could do much to improve a soil that "only nourishes rushes and is deficient in water" (!); and he accepts without question the statement he believes to have been made to him by the Principal of a college, that the number of his students is 300, that the annual admissions are forty, and that the course extends over "from two to three years." Several mis-spellings and printer's errors occur in the pages.

Candia. Ricordi di Escursione. Di Vittorio Simonelli. Illustrate con Fotografie e Disegni dell' Autore. Parma: L. Battei, 1897. Pp. vii + 180. *Price L.*3.

We have read this little book with much pleasure. It does not pretend to be strictly scientific; only in the appendix are a few pages devoted solely to the geography, geology, fauna, etc., of the island. But it contains, as the author says in the preface, *un po' di tutto*—sketches of persons and places, scraps of history, fragments of science and folklore—from which a very good idea can be formed of life in this unfortunate island.

Christians and Turks affect certain outward distinctions in dress and customs, but otherwise they are as like as the leaves of the same tree, and both are equally lazy. Their hatred of one another seems, however, ineradicable, and Signor Simonelli tells many anecdotes of the brutalities committed in the numerous insurrections, such as the suffocation of more than 400 Christians in the cave of Melidoni in 1824. Sometimes the Christians' turn came, and they used their advantage with equal ferocity. Ignorance and superstition are rife, and no doubt tend to foster the religious antagonism which has so much retarded the progress of a country that has many advantages in situation, soil, and its sturdy inhabitants, and many attractions in scenery and antiquities. Signor Simonelli seems to have been well received in

all parts, in the Turkish quarters and in the monasteries, inhabited by muscular Christians, ever ready to exchange the cross for the rifle, as well as among the independent Sphakiotes of the White Mountains.

The map is small and rough, but it has the traveller's route clearly marked. The illustrations are useful, but might have been better reproduced.

A Short Popular History of Crete. By J. H. Freese, M.A. With Introduction by P. W. Clayden. London: Jarrold and Sons, 1897. Pp. 116. *Price* 1*s.* 6*d.*

Although interest in the affairs of Crete has been somewhat obscured by the larger questions to which the situation in the island has given rise, there are many persons who will welcome this unpretentious work. Besides sketching the history of Crete from the earliest times to the present year with as much clearness as its complicated and distressful nature permits, the author has supplied an account of the Ethnike-Hetæria and the Greek War of Independence, and an Appendix of Cretan Songs and Legends. This fragrant and fertile island, possessing a most equable climate and possibly the best anchorage in the Mediterranean, has been for 2000 years the spoil of successive conquerors, and its population is now little more than a quarter of what it is said to have been at an earlier period. That it will never be free from "broil and battle," or have a chance of prosperity under its present rulers, is the opinion strongly expressed by Mr. Clayden in the Introduction. The book contains two maps, but a *précis* of the chapters or an index would also have been of service to the reader.

Die Insel Sansibar. Von Dr. Oscar Baumann. Mit einer Originalkarte der Insel und einem Plane der Stadt Sansibar. Leipzig: Duncker und Humblot, 1897. Pp. 48. *Price M.* 1.80.

Dr. Baumann has given us in this pamphlet a good account of Zanzibar. The text he claims to be but an introduction to the map, which he thinks the chief part of the publication. The description of the island, its geology and flora, its people and commerce, is, however, rather more than he claims for it, and is well worth reading.

Dr. Baumann hopes that the Arab clove-growers will not be able to withstand the blow which the abolition of slavery will give them, and that the plantations will pass into European hands.

He recognises the difficulties of government, when a native ruler has to be respected, and yet European ideas introduced against the will of the people.

Koloniales Jahrbuch. Beiträge und Mittheilungen aus dem Gebiete der Kolonialwissenschaft und Kolonialpraxis. Herausgegeben von G. Meinecke. Berlin: Deutsche Kolonial-Verlag, 1897. Neunter Jahrgang, Heft 1-2, pp. 96; Heft 3-4, pp. 97-322.

This year-book is as usual full of interest. There are two papers on the proposed German East African Railway which are well worth perusal. The line, which is only intended for commercial purposes, is to go from Dar-es-Salaam, *viâ* Bagamoyo (branch line), Mrogoro, Tabore, Tanganyika to the Victoria Nyanza—1773 km. in length. The first part of the railway, 291 km., is estimated to cost 11,850,000 M. The route has been surveyed by Lieutenant Schlobach.

Graf von Schweinitz calls attention to the importance of the British Victoria Nyanza Railway in a political and strategical respect, and shows its great importance.

There is a good summary of the discussion on Acclimatisation, which took place at the last International Geographical Congress. Mr. Silva White's views are held to be too pessimistic.

H. Hesse has an important article on German Colonial Policy, and Colonisation in Brazil is dealt with by the Editor presumably. Graf Pfeil writes on the proposed Criminal Colony in S.W. Africa: he recognises its difficulties, but on the whole supports the idea.

Cabot's Discovery of North America. By G. E. Weare. London: John Macqueen, 1897. Pp. 343. *Price* 10*s.* 6*d.*

"In the year 1497 John Cabot (Giovanni Caboto), who was probably of Genoese origin, but had become a naturalised Venetian after fifteen years' residence in Venice, sailed from Bristol on a voyage of discovery, under the direct authority of Henry VII. of England. He had eighteen persons on board (most, if not all, of whom were men of Bristol), and he succeeded in discovering the continent of North America, upon which he planted the flag of England." Upon the possession thus taken was founded the English claim to the continent of North America antagonistic to that of Spain, whose claim was founded not upon priority of possession, but upon a Papal bull granted in 1493.

Columbus, another Genoese, had in 1492 discovered Cuba, which he firmly believed to be Japan. He also imagined that the adjoining islands were near India, and hence they were called the "West Indies." Columbus does not, however, appear to have landed upon the continent of North America, although he did upon that of South America. It was Cabot who first landed, in 1497, upon the North American continent on a cape which is designated "Cavo de Ynglaterra" (Cape of England) on his own map, which "is drawn on an ox hide, 5 feet 9 inches long by 3 feet wide, on a scale of fifteen Spanish leagues to a degree, and is now preserved in a glass case in the Naval Museum at Madrid. This map is an exquisite production in colours and is richly decorated in gold. It is probably the best designed map of the period."

Whilst Dr. G. E. Dawson, an eminent Canadian authority, considers that Cabot's "Cavo de Ynglaterra" can only be Cape Race (from Latin *rasus*, smooth), Mr. Weare states that "the evidence is not sufficiently reliable to enable us to point with any degree of certainty to the place where John Cabot planted the English flag in 1497." At the commemoration at Bristol, on 24th June 1897, of the 400th anniversary of the discovery of North America by John Cabot, in the Bristol ship *Matthew*, Lord Dufferin remarked that "to John Cabot England was indebted for two such precious possessions of the Crown as the great Dominion of Canada, and the Island of Newfoundland with its magnificent fisheries." Mr. Weare makes for Cabot the much greater claim of having acquired for England the continent of North America. Whatever may be the actual fact, that continent is now an Anglo-Saxon possession, and Mr. Weare's work, which shows so much industry and erudition, proves that John Cabot is entitled to a much higher place than has yet been accorded to him.

Twenty Years on the Saskatchewan. By the Rev. W. Newton, Hon. Canon of Saskatchewan. London: Elliot Stock, 1897. Pp. viii+184.

In 1875 Mr. Newton settled at Edmonton, Alberta, and for sixteen years, as he tells us, he was the only clergyman of the Church of England in a district as large as England. In his frequent journeys he saw much of the "pleasant Saskatchewan country," and of the Indians, half-breeds, and traders, and he narrates his observations in a somewhat fragmentary manner. He experienced the disorganisation consequent on the transfer of the Hudson Bay Company's territory to the Canadian Government, and to this he mainly attributes the rising under Riel in 1885. The

book makes no claim to be of scientific weight, for the author writes as "a simple missionary"; but there is surely an excess of simplicity in the statement (page 166), "our latitude somewhat corresponds with that of Great Britain, *yet our seasons are later, because we are far to the west.*"

Diary of a Tour through Great Britain in 1795. By Rev. Wm. MacRitchie. London: Elliot Stock, 1897. Pp. 169.

One of the best features in this book is the portrait which its author, the minister of the parish of Clunie in Perthshire, unconsciously paints of himself. He was a scientific man, a geologist, and especially a botanist. He was a theatre-goer, and saw Mrs. Siddons play Lady Macbeth at Lancaster. He was not a Sabbatarian, for he travelled on Sundays, and exclaimed, "Cannot man be devout in the fields as well as in the pulpit?" He was opposed to luxury, and was glad to escape from Liverpool, which he considered a "large, irregular, busy, opulent, corrupted town." Leaving Clunie on 22nd June, he reached London on 21st July and put up at the Bull and Mouth near Aldersgate. He did the sights of London with much thoroughness, and his carefully edited Diary furnishes an interesting glimpse of Great Britain at the close of the eighteenth century.

Grant Allen's Historical Guides. Cities of Belgium. London: Grant Richards, 1897. Pp. 230. *Price* 3*s.* 6*d.*

The Belgian cities here described are Bruges, Ghent, Brussels, and Antwerp, all most interesting historic towns. Belgium contains no more historic spot than Waterloo, yet Mr. Grant Allen remarks, "Unless you are a military man or a student of tactics, I do not advise you to undertake the dull and wearisome excursion to Waterloo." He advises historical students to save time by *not* visiting Waterloo and go to Louvain "on account of its magnificent Hotel de Ville, and in order to make a better acquaintance with Dierick Bouts, the town painter." The defeat of Napoleon and Wellington by Dierick Bouts is complete.

Le Marine da Guerra del Mondo al 1897. Dell' Ing. Lorenzo d'Adda. Milano: Ulrico Hoepli, 1897. Pp. xvi+320. *Price L.*4.50.

We have already noticed several of the useful *Manuali Hoepli*. This one on the navies of the world is equally thoroughly compiled. A noticeable feature is the outline sketches of the various types of vessels, showing how their guns are mounted, etc. The numbers of the vessels of different classes in the British navy do not agree with those published here, but this may be due to a different method of classification.

Hints to Meteorological Observers, with Instructions for taking Observations and Tables for their Reduction. Prepared under the direction of the Council of the Royal Meteorological Society. By William Marriott, F.R.Met.Soc., Assistant Secretary. Fourth edition, with Illustrations. London: Stanford, 1897. Pp. 47. *Price* 1*s.*

The fourth edition of this valuable guide for meteorological observers has just appeared, and has been brought up to date. By following Mr. Marriott's practical hints observers will avoid many difficulties, and ensure that uniformity of observation which is essential for the comparative study of climates. The cloud nomenclature, we are glad to see, is that of the international cloud atlas; and considerable attention is given to other points than the forms of clouds, such as their direction, point of radiation, density, etc., which are of great importance in forecasting local weather.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE ECONOMIC VALUE OF RHODESIA.

By F. C. Selous, F.R.G.S., F.Z.S.

(*With a Map.*)

But little more than two centuries and a half have elapsed since the first colonists from Western Europe left their mother lands in search of new homes across the sea; for it was not till 1620 that the *Mayflower* set sail from England, carrying with her the Puritan fathers, who, with their wives and families, may be considered the first British colonists who settled on the Continent of America, whilst another forty years had elapsed before Van Riebek founded the first Dutch settlement at the Cape of Good Hope. Since those dates emigration from Europe has continually gone on; at first, fitfully and intermittently, but latterly, owing both to the rapid increase of population in the British Isles and other parts of Europe, and to the ever increasing facilities for ocean transport, at a rate which bids fair ere long to people with Europeans every portion of the globe where the climatic conditions are such that the white man can live and thrive and rear strong, healthy children. The last half century has seen the spread of the white race across the whole North American continent, and witnessed the colonisation by Europeans of immense areas in Australia, Tasmania, and New Zealand.

Until recently, however, Africa has not been looked upon with favour as a country in which to settle. The original Dutch immigrants, augmented by a number of French Huguenots who had expatriated themselves after the revocation of the Edict of Nantes, increased and multiplied beneath the genial climate of the Cape Peninsula, and gradually occupied the land to the north and east; but as their numbers were augmented to but a very slight degree from outside, and as almost every inch of ground had to be won from hostile native tribes, their progress was but slow—so slow, indeed, that when the Cape Colony was finally ceded to the British after the Peace of Paris in 1815, it did not

extend as far north as the Orange river, nor as far east as the Great Fish river, and beyond these boundaries the whole of Africa south of the Equator was an unknown wilderness, as yet untrodden by the foot of a North European. Since that time great progress has been made. The flight of a large number of Boers from British rule in 1836, and their migration northwards across the Orange and Vaal rivers opened up much new country, and proved that the high open plateaus of what are now called the Transvaal and the Orange Free State were eminently healthy for Europeans.

Of the countries to the north of the Limpopo but little was known until very recently. In the year 1890, however, Mr. Rhodes' pioneers occupied the high plateau of Mashonaland, and subsequently wrested Matabililand from its savage possessors. These vast territories are at the present time attracting much attention, not only in Great Britain, but also in America and in Australia. At any rate, we find to-day in the newly opened lands lying between the Limpopo and the Zambezi, English-speaking men from every portion of the British Empire, as well as a number of American citizens; and it is because of this general interest in the temperate plateaus of the interior of South Africa, and because of the ever increasing difficulty of finding unoccupied land suitable for colonisation by the surplus population of Europe, that I propose to say a few words concerning the economic value of these territories as a field for European colonisation.

To begin with the climate. It must be obvious that the hygienic conditions of a country like Rhodesia, which is larger than France and Germany put together, and which includes the low-lying valleys of the Zambezi and the Limpopo, as well as the high open downs of Matabililand and Mashonaland, must be very diverse; and it may be broadly stated that only those portions of the country are suitable to North Europeans where the altitude above sea-level renders the climate temperate. For in tropical Africa malarial fever is the white man's most deadly enemy—an enemy in whose despite Europeans can never hope to establish themselves and colonise the country; and as this most insidious disease is everywhere prevalent in Rhodesia where the altitude is less than 4000 feet above sea-level, it is only the elevated backbone of the country, which forms the watershed between the Zambezi and the Limpopo in the west, and the Zambezi and the Sabi in the east, which can be looked upon as likely to become peopled by white men; whilst in Eastern Mashonaland, where the country is extremely well watered, many people suffer much from fever—though of a very much milder type than in the hot tropical lands in the basins of the great rivers—even up to an altitude of over 5000 feet. Still, I think that the cultivation of the land and the draining of the swamps will gradually eliminate the causes of fever on the highlands, and I look upon all those portions of Rhodesia which lie at an altitude of over 4000 feet above the sea as certainly destined to become peopled by white men. Possibly in the distant future, when the highlands of Rhodesia have become thickly peopled, the white man may be able to extend his livable area to a somewhat lower level than the 4000 foot altitude, below which I now consider the

country unhealthy for Europeans; but as almost the whole country at present lies waste, it would be as well to settle up the highest and healthiest portions first. The superficial area of that portion of Rhodesia which lies at an elevation of 4000 feet and upwards extends to approximately 26,500 square statute miles, whilst 72,500 square statute miles may be added which lie between 3000 and 4000 feet. The whole of the watershed, which extends from some twenty miles to the westward of Buluwayo, north-eastwards to Salisbury, and from thence south-eastward to the sources of the Ruenya, Odzi, and Pungwe rivers, attains an altitude which is never less than 4700 feet, and which rises to the east of Salisbury to from 5400 to 6000 feet, and in the Inyanga country at the source of the Ruenya river to over 7000 feet.

All people are not equally susceptible to malarial fever. I myself, for instance, although I have suffered much from fever in the Zambezi valley and the swamps of the Chobi, have never contracted fever in any part of the Rhodesia highlands; but many people suffer much from this disease in the town of Salisbury in Mashonaland, which is 4900 feet above sea-level, and from my own observation I should say that in the copiously watered highlands of Eastern Mashonaland fever ceases entirely to exist only at an elevation of about 5400 feet.

Once beyond the range of fever, however, the climate of this part of Africa is probably one of the finest in the whole world. Even in the hottest weather the heat is not excessive, for the thermometer seldom registers a temperature of over 90° in the shade on the high plateaus of Eastern Mashonaland—and 90° in the shade is not very trying at an altitude of over 5000 feet—whilst the nights are always cool and bracing the whole year round. During the winter months, namely, in May, June, and July, the nights are cold and frosty, and the days bright and clear—pleasantly warm but not hot. During the months of November, December, January, February, and March, heavy rains may be expected, with thunder-storms during October and April, and sometimes a little light rain during the winter months. The rainfall is, however, very unevenly distributed over the five months I have mentioned, as in some years continuous rain sets in early in November, whilst in others little or none falls till late in December. As a rule the heaviest rains take place after Christmas. The average annual rainfall would be probably over forty inches, though of late years it has frequently been much below that figure, droughts or inadequate rains having been prevalent all over South Africa since 1891. In the rainy season, which ended in April of that year, however, a rainfall of fifty-three inches was recorded in Salisbury, Mashonaland.

The altitude of Western Matabililand is not as great as that of Eastern Mashonaland, but fever is not at all prevalent there, and I think I may fairly say that all those portions of that country which lie at an elevation of over 4000 feet are exceptionally healthy and thoroughly suitable for colonisation by Europeans. I attribute the superior healthiness of Western Matabililand to that of the countries lying farther eastward, whose altitude above the sea is greater, to two causes. The first is, that during the last sixty years Western Matabililand—that is, the

country in the actual occupation of the Matabili—has been thickly inhabited, much of its soil annually cultivated, and its rank herbage constantly fed down by large herds of cattle. During the same period, the countries farther east have been depopulated, their former inhabitants having been driven by the Matabili from the open country into the hills, and their cattle swept off. Thus large areas in that country have relapsed into a state of nature, and will have to be cultivated by Europeans and fed down by imported cattle before the fever fiend is banished. In the second place, Western Matabililand, though well watered, is a much drier country than the higher downs lying farther eastward, which are so copiously watered by innumerable small streams, that at the end of the rainy season every valley becomes a morass. In the future I feel sure that this superabundant water-supply will prove most valuable for agricultural purposes, as the bogs will be drained and cultivated, and the surplus water stored for purposes of irrigation during the long dry season; but at present, it is doubtless the presence of these morasses which is accountable for the prevalence of malarial fever in Mashonaland at an altitude where one would imagine that that disease ought not to exist. I have gone into this question of malarial fever in Rhodesia at some length, because I consider it a matter of vital importance to any intending settler in that country.

There are portions of Matabililand, Mashonaland, and Manica, where Europeans can live and thrive and will see their children grow up strong and healthy; but it is absurd to assert, as some people do, that the whole of that vast territory is a white man's country. The excessive drinking of bad spirits is, I believe, often more responsible for ill health in Rhodesia than the climate, but it certainly is not responsible for all the fever in that country; and it may be safely asserted that Sir Wilfred Lawson himself would not long remain free from that disease were he to camp out during the rainy season on the banks of the Zambezi. Now I have spoken of the climate of the highlands of Rhodesia as temperate, and I think I am justified in doing so, as Europeans are able to work at any time of year, all day long, in the full heat of the sun. I do not think the heat is ever greater than it is in summer time in Paris or Vienna, whilst in Buluwayo and Salisbury the nights are always cool and pleasant, which is not invariably the case in the cities of central Europe.

I will now consider Rhodesia from an agricultural and pastoral point of view, but before doing so must point out that at the present moment the whole of South Africa is not in its normal condition, but is suffering from a combination of plagues, which have reduced it at the present moment to a very pitiable state. In the first place, the terrible scourge of rinderpest which was probably originally introduced into North-eastern Africa from India or South-eastern Europe some seven or eight years ago, after first sweeping the great herds of cattle belonging to the Masai from the face of the earth, and causing thousands of their owners to die of starvation, has been creeping gradually southwards ever since. Like a destroying angel it passed through Central and East-central Africa, leaving millions (probably hundreds of millions) of dead animals on its

path. Wherever it has been, the great herds of buffaloes, and all the various beautiful forms of antelopes which graced the plains and forests of Central Africa, and without which the country becomes a dead and dreary wilderness, have almost completely disappeared. Creeping ever southwards, this dreadful scourge reached the Zambezi in 1895, and early the following year it appeared amongst the cattle in Matabililand. In March 1896 there were over 100,000 head of horned cattle in that country. By the end of the year there were probably not 500 left alive. From Matabililand the plague travelled rapidly southwards, and after destroying the almost countless herds of the Bechwana tribes, invaded the Dutch Republics of the Transvaal and Orange Free State, and finally crossed the Orange river, which it was hoped would prove a barrier of defence to the Cape Colony; but by the last advices, it is still advancing, and will probably sweep through the whole of South Africa to the sea.

Now, were this terrible disease of rinderpest indigenous in South Africa, it would render that country a very undesirable one to live in. But it is not so, any more than it is indigenous in England. This, I think, may be positively asserted since the coasts of South Africa have now been known to Europeans for four hundred years, and it is certain that during that period no such visitation has swept through the land, for the coast tribes are known to have been constantly in possession of cattle, whilst there is no record of any such disease as rinderpest ever having visited their herds. Thus the rinderpest is an evil, the effects of which, though very terrible, will only be temporary, as when it has at last died out for lack of fuel, and the country after an interval has become free from its poison, fresh stock will be imported from South America, Australia, and Europe, whose progeny will gradually restock the land.

Another plague from which South Africa has been suffering of late years is locust swarms. For seven years have these winged hosts devastated the whole country from the Cape to beyond the Zambezi, causing famine amongst the natives and making agriculture wellnigh impossible. In the autumn of 1895 I cleared about forty acres of waste land in the Matabili country, and sowed some thirty acres with maize, planting the remaining ten acres with blue gum-trees. In the following February I had a nice crop of maize coming on. The stalks stood about three to four feet high, and the cobs were already forming. One afternoon the Kaffirs called my attention to a vast cloud of locusts drifting up over the hills to the south-east. Nearer and nearer they came, and about four o'clock settled in one dense mass, like a heavy fall of snow, on my thirty-acre maize patch. In two hours there was nothing left but the bare stalks, and some of these were actually eaten off to within a foot of the ground. The maize patch seemed to satisfy the locusts for the time being, but the next morning a lot of them turned their attention to an acre and a half of melons, where some of the fruit was fast ripening. They did not interfere with the melons, but effectually destroyed them by eating off all the leaves and stalks, leaving the fruit to dry and shrivel up.

In September 1896 I visited Amatongaland, a country lying to the

south of Delagoa Bay, and here I found that the natives had suffered so much from the devastations of locusts, that many of them had given up cultivating the land in despair, saying that it was better to eat their seed corn than sow it for the benefit of the locusts. These people were selling their cattle to European traders for maize, which I was told had been imported from Bombay.

The present plague of locusts in South Africa has, I believe, been a particularly prolonged and destructive one, though history, I am sorry to say, teaches that such visitations are to be expected from time to time, since the devastations of these insects, and the resultant famines amongst the natives, have been chronicled by Dos Santos and other early Portuguese writers, and the plague has apparently recurred from time to time ever since. However, locusts are not always present in South Africa. My own knowledge of Rhodesia dates back to 1872, and from that year until August 1891, I never saw such a thing as a locust, either in Matabililand or Mashonaland, or in any of the territories I visited during that time to the north of the Zambezi, and as the present plague must have almost spent itself I think intending settlers in Rhodesia may now look forward to seeing the country free from these pests for some time to come.

Lastly, South Africa has suffered of late years from a deficient rainfall, which has caused much distress and discontent among the natives, and made agricultural operations very difficult for Europeans. The last rainy season, however, has been a fairly good one in Rhodesia, and one can only hope that the period of droughts or partial droughts has come to an end for the time being, for, without water, the agriculturist can do nothing in that country. Given, however, an abundant water-supply in the way of rain or by means of irrigation, and almost anything can be grown there.

The natives of course only raise crops during the rainy season. They grow maize, three kinds of kaffir corn (sorghum), ground nuts, three varieties of beans, pumpkins, gourds, water-melons, sweet potatoes, and in Mashonaland tomatoes, peas, and most excellent rice. The European missionaries have successfully cultivated wheat and many different kinds of fruits and vegetables in their gardens.

Indeed, it may be said that anything that can be grown in the Cape Colony will grow in Rhodesia. Wheat, however, can be grown successfully during the dry season only by means of irrigation, for if sown during the rains it becomes rusted. The same rule applies to oats. The facilities for irrigation are much greater in Eastern Matabililand and in Mashonaland and Manica than in Western Matabililand, and I think that those parts of the country are capable of producing all the flour that will be required for consumption in Rhodesia, even should considerable centres of population spring up in different parts of the country in connection with the mining industry. This may not seem a very grand achievement, but should Rhodesia prove to be self-supporting as regards its bread supply, it will be the only colony in South Africa that is so, as there is not a town in that country where the bulk of the bread is not made from flour imported from Australia.

I think it quite impossible that wheat or any other agricultural product can ever be grown in Rhodesia for exportation, for even supposing that a wheat could be found that would ripen without suffering from rust during the rainy season, which of course would render it possible to put very much larger areas of ground under cultivation than would be done by a system of irrigation during the dry season, the cost of transport to Europe would effectually prevent the Rhodesian farmer from entering into competition with the wheat-growers of America or Russia. As for rice, Rhodesia could never compete with India, but in time to come it ought certainly to tin its own fruits, make its own jams, and be entirely self-supporting as regards every kind of vegetable product which is now imported into South Africa from either California or Australia.

I have said that fruits and vegetables of all kinds grow well in Rhodesia, and I speak from experience, as I have not only seen them grown in the gardens of missionaries and settlers in many parts of Matabililand, Mashonaland, and Manica, but have grown in my own garden most excellent potatoes, cabbages, cauliflowers, peas, turnips, parsnips, lettuce, vegetable marrows, beetroot, broad beans, scarlet runners, and tomatoes.

There is one industry connected with agriculture which I think might be successfully tried in Rhodesia, and that is the production of oil from ground nuts. At the present time thousands of tons of ground nuts are annually exported to Rotterdam and Marseilles from South-eastern Africa for the manufacture of oil. These nuts could be bought very cheaply and in immense quantities from the natives of Rhodesia, and I think it possible that it would pay to crush them locally, and export the crude oil to be clarified in Europe.

As to the soil of the high plateaus of Rhodesia, my knowledge on the subject of soils does not enable me to speak with authority. Light sandy soil prevails, and is in fact almost universal wherever the hills are of granite formation. This sandy soil certainly looks very poor and has been summarily dismissed as such by all those who have rushed through the country in order to qualify themselves to write it down, but on the other hand, the natives appear to grow very good crops in it. When in the Maputa country, near Delagoa Bay, where the natives are said to grow remarkably good crops, I noticed that the soil was apparently almost pure sand, so it is possible that the soil of the high plateaus of Rhodesia may also prove to be better than it looks. Possibly the natives change their ground very often, as they use no manure except the ashes of the burnt branches of the trees they chop down when they first clear a piece of forest land for cultivation.

My conclusion as regards agriculture in Rhodesia is therefore that, given a year of normal rainfall and freedom from the visitations of locusts, good crops can be grown—though only by irrigation during the dry season—of every vegetable product required by civilised man, including tobacco. For his market, however, the Rhodesian farmer must look to the local towns, the rapid growth of which must be entirely dependent upon the number of the gold-bearing quartz reefs which eventually prove

to be payable. The stock farmer might look for a somewhat wider market, for when the railway system, which is now fast approaching Buluwayo from the west, and Umtali from the east, has been completed throughout the country, he would be able to export slaughter cattle to Kimberley and Cape Town, and also to Johannesburg if the present heavy import duties on live stock were removed, as it is probable they will be, owing to the recent destruction of the cattle in the Transvaal itself by rinderpest having made it impossible for that State to supply its own markets.

At present there are practically no cattle in Rhodesia. The rinderpest last year swept every herd in the country off the face of the earth. But that scourge has passed and is not likely ever to occur again, and in course of time the whole country will be restocked. That Matabililand is a good cattle country no one can deny who remembers the innumerable herds which covered the land in Lo Bengula's time, and I can testify from my own experience that all the high plateau lands of Rhodesia are equally suitable for horned cattle, the easterly portions of Matabililand and the high downs of Mashonaland being, in my opinion, even better suited for cattle-ranching than the western portion of the former province. In the moist upland valleys of Eastern Rhodesia there is a kind of short, sweet, succulent grass, which springs up towards the end of the dry season, and on this grass cattle and horses thrive well, just at the time of year, in August, September, and October, when farther west, where this grass does not grow, the pasture has become as dry as tinder, and very deficient in nourishment, causing all stock to become very lean and the old animals unable to survive until a new crop of grass springs up after the first rains. In the country to the east of Salisbury, and, in fact, all over Eastern Mashonaland, I have found that breeding cattle, or indeed any cattle which are doing no work, except very old animals, keep in good condition in ordinary years the whole year round. Heavy flights of locusts destroying the grass, or an insufficiency of rain causing it to wither prematurely, would, of course, affect the condition of cattle.

As far as I have been able to learn from the natives, the cattle indigenous to Rhodesia were very free from disease. The lung sickness (pleuro-pneumonia) originally introduced into South Africa from Holland, spread to Matabililand in 1854, but was unknown in Mashonaland until 1890, when it accompanied the pioneer expedition to that country. The effects of this disease are most disastrous amongst a herd of uninoculated cattle, but if the year's calves are inoculated regularly every year, as is the practice of all careful farmers in South Africa, there is but little to be feared from it, and it is now most virulent amongst native cattle, which have never been inoculated. Besides lung sickness, there is no other disease at all prevalent amongst cattle in Rhodesia, as far as I know. A few die annually from gall sickness, which is apparently produced by the richness of the grass, as cattle are always very fat when they die of this disease, which is an affection of the liver and gall bladder.

Besides cattle, the natives in Rhodesia used to possess considerable herds of sheep and goats, which, however, have now ceased to exist, as

they have been all killed and eaten, owing to the scarcity of food caused by the rinderpest and the late war. The native sheep are of the fat-tail species found all over Africa, and do not grow any wool. Whether Merino sheep will thrive in Rhodesia, as they do in parts of the Cape Colony, Natal, the Orange Free State, and the Transvaal, remains to be seen. Some years ago a small flock was taken up to the high downs near Fort Charter in Mashonaland, and this small flock has thriven exceedingly well, the sheep producing a good crop of wool and the mortality amongst the lambs having been very small. So far as it goes, the experiment has been thoroughly successful, but only further experience will prove whether the country is capable of carrying large flocks of wool-bearing sheep.

As regards other live stock, pigs and donkeys do well, the former thriving wonderfully in the damp valleys of Eastern Mashonaland, whilst the latter can live everywhere. Well-bred fowls are subject to much disease, and the native birds are very diminutive and lay very small eggs. Horses do very badly in all parts of Rhodesia, being subject during the rainy season, and to a certain extent at other seasons of the year as well, to the disease known in South Africa as horse-sickness, which, although only occasionally prevalent at the present day in the Cape Colony and Natal, annually destroys large numbers of horses in the Transvaal and in Bechwanaland, and becomes even more virulent farther north. Horses apparently contract this disease when feeding upon dewy grass during the night or early in the morning, but they sometimes appear to contract it even when constantly stabled and fed on nothing but dry food. As a rule, however, a large percentage of horses that are regularly stabled during the rainy season, and never allowed to eat grass until it has been thoroughly dried by the sun, escape the disease. But with very few exceptions, all unacclimatised horses allowed to graze day and night during the rainy season contract the disease, which is fatal to over ninety per cent. of them. There are two forms of the disease, that in which the head swells, known to the Boers as Dikkop ziekte, being the most virulent. Should a horse really have and recover from the Dikkop ziekte, he becomes for the future immune from any form of horse-sickness, and is known as a "salted" horse. Should a horse, however, recover from the milder form of the disease, in which the head does not swell, he will very likely later on contract and die from the more severe form. One portion of Rhodesia—the Inyanga country—lying north-east of Umtali, which is over 7000 feet above sea-level, will possibly prove to be free from horse-sickness, and as the progeny of salted mares by salted stallions in other parts of the country usually only contract the disease in a very mild form, an acclimatised race may eventually be evolved; but at present Rhodesia cannot be called anything but a bad country for horses.

As the success of farming in any country depends very much upon the labour supply and the cost of the same, I will add a few words on this subject. Just now the natives in Rhodesia are in a very unsettled condition, into the causes of which it would be impossible for me to enter in the limits of this paper, nor do I care to hazard an opinion as

to how long it will be before that state of unrest comes to an end. But when peace has been firmly established, and the distrust which now prevails on the part both of blacks and whites alike has ceased to exist, I do not think there will be much difficulty in obtaining a supply of labour for farm work in Rhodesia for any one who will treat the natives fairly and justly. They hate mining work, and it is difficult to get them to work underground even for high wages; but farming work they do not object to, and personally I never had any difficulty in obtaining the labour I required when carrying on farming operations on a small scale in Matabililand in 1895 and 1896. I paid my men fifteen shillings a month, and their food cost fifteen shillings a month per man besides, as at that time grain of all kinds was very dear in the country. The Kaffirs I employed, on the whole, worked very well. When I found that any of them were lazy, I paid them for the number of days they had been working and got rid of them, and I think it is much better to do this than to knock them about and try and force them to work. As I have said before, the greater part of the men I employed worked well and cheerfully.

Now, from what I have said in the foregoing pages, it will be seen that I do not look upon South Africa in general, nor Rhodesia in particular, as a ready-made Paradise for a man to step into. Nor do I believe that such a spot is to be found in any unoccupied part of the world at the present day: the earthly paradise of a happy home in a wild land must be created by a man's own labour, patience, intelligence, and perseverance. The higher portions of Rhodesia are certainly fitted for colonisation by Europeans, and sooner or later the white race will spread over all the elevated portions of that country. The chances of success for farmers will depend almost entirely upon the richness of its gold deposits, at any rate for some time to come; but with or without large markets for produce, it is at present a country in which a man can choose a pleasant spot for a homestead, enjoy a genial climate in which his wife and children will thrive, and with a few cattle be able to live comfortably, and grow everything he requires in the way of fruit and vegetables in his own garden. If this picture should be considered overdrawn, I would refer my critic to the mission stations of Hope Fountain, Shiloh, and Inyati. What was done by the men and women, who years ago made pleasant homes for themselves in Matabililand, can be done by others all over the highlands of Rhodesia, and I trust that it will be done by colonists of British blood rather than by Dutch Boers, for I think that the ultimate supremacy of Great Britain in South Africa depends more upon the settlement of her sons upon the land than upon the building of cities upon a gold or diamond mine, which must sooner or later cease to exist.

WINDS AND OCEAN CURRENTS.

By W. M. Davis, Professor of Physical Geography, Harvard University.

In the discussion on the causes of ocean currents led by Croll and Carpenter some years ago, these able investigators reached directly opposite conclusions. Croll gave no value to oceanic convection, and argued that the difference of equatorial and polar temperatures acted on the ocean only through the mediation of the atmosphere; further, that during the northern aphelion winter, the greater strength of the north-east trade-winds would drive all the warm equatorial waters of the Atlantic south of Cape San Roque, and thus leave the North Polar regions untempered by the extension of the Gulf Stream. This fundamental proposition in his glacial theory has always seemed to me its greatest weakness; for if the north-east trades are strengthened by increased equatorial-polar contrast of temperature, so are the prevailing westerly winds of the northern hemisphere, and under their combined propulsion, the North Atlantic eddy, of which the Gulf Stream is but a part, would still flourish. Carpenter, on the other hand, contended that the differences of temperature in the ocean itself would suffice to cause a circulation, and placed a less value on the winds than on convection as a cause of surface currents. The subject still offers an interesting field for discussion, and certain parts of it, that fall under what may be called the terrestrial rather than the planetary system of atmospheric circulation, seem in particular worthy of further statement.

By planetary circulation is here meant such a movement of winds and waters as would take place on a planet in general similar to ours, but with an axis vertical to the plane of its orbit, and consequently without seasonal changes of temperature throughout the year. On such a planet, the several members of the atmospheric circulation —trades, prevailing westerlies, and polar winds—would blow with steady average velocity from month to month; their dividing belts of baffling breezes and calms would remain fixed; the doldrums at the equator, and the horse-latitudes at about thirty degrees north and south. The ocean currents would flow steadily, whether driven by the winds or dependent on their own convection. The west-flowing members of the several northern and southern oceanic eddies would probably be confluent along the equator, and it may be contended that, under these conditions, there would be no equatorial counter currents, such as prevail near the equator on the actual earth.

The terrestrial circulation resembles the planetary circulation in its larger features, but possesses seasonal variations of velocity and shifts of position and direction that are of much interest. For brevity of presentation, I shall here follow a deductive order of statement in explanation of these seasonal features; but they might all be substantiated by inductive generalisation, if time allowed. In winter, the poleward temperature gradient in the atmosphere is distinctly stronger than in summer, and the winds therefore move faster in the cold than in the

warm season. This is especially true in the middle temperate latitudes, where the poleward gradient is strongest, and where the prevailing westerlies often gain the strength of gales in the winter hemisphere. As far as I can find records of the velocities of the surface ocean-currents they vary in sympathy with the varying velocity of the winds. Hence, after showing that the general features of the zones and the general circulation of the winds and waters are permanently established through the year as planetary features, it is interesting to add that they all exhibit seasonal fluctuations, or terrestrial features; that in the temperate latitudes in particular they become relatively warm and quiet in summer, and cold and active in winter; and this seasonal fluctuation is exhibited much better in the northern hemisphere than in the southern, on account of the excess of land in the former, and the broad expanse of water in the latter.

A curious point may be noted here, from which confirmation may be drawn for the wind-driven origin of the surface currents. In the atmosphere, the poleward temperature gradient is stronger in winter than in summer; but in the ocean it is weaker in winter than in summer. This is because the low polar temperature of the atmosphere in winter much more than compensates for the migration of the heat equator into the other hemisphere, and for the consequently greater distance over which the equatorial-polar contrast of temperature is distributed. But in the ocean, the polar temperatures are practically unchanged through the year, and the only cause for a variation in the poleward temperature gradient is the migration of the heat equator a little distance into the other hemisphere, whereby the gradient is weakened. Truly, the variation of the temperature gradient in the ocean must be very small, but as far as it goes, it should make the currents that depend on it stronger in summer than in winter. This is not the case with the surface currents, and hence their cause can be better found in the atmospheric circulation, with whose velocity they vary sympathetically.

If the lands and waters were symmetrically distributed with respect to the equator, the seasonal migration of the heat equator and all the resulting variations in the several members of the wind system would be equally symmetrical. One must soon be persuaded of this on examining charts of the winds and ocean surface-temperatures, and discovering how closely the local peculiarities of winds and isotherms vary with the local irregularities of land and water configuration. Further mention of actual irregularities in winds and currents will be made below, under the name of individual features; for the present, only certain symmetrical features of an ideal terrestrial circulation will be considered.

When the heat equator stands on the geographic equator, the trade-winds blow obliquely towards it from either side and die out in the doldrums. When the heat equator migrates into the northern hemisphere, departing from its average position by some ten degrees in order to follow the sun, then it may be expected that the south-east trade of the other hemisphere would cross the equator and swing round (now being under the influence of a boreal or right-handed, instead of an austral or left-handed deflective force), so as to blow from the south-west

for the rest of the way into the doldrums. The continuity of this curving wind will depend on the continuity and strength of the pressure gradient that governs it; if the latter is well developed, the extension of the trade across the equator, and its appropriate deflection in the hemisphere that it enters, may be confidently expected. Six months later, when the sun and the heat equator move south, the north-east trade will blow across the equator and beyond it, suffering an appropriate deflection after entering the southern hemisphere. Hence there will be two belts, each about ten degrees wide, adjoining the equator on the north and south, one of which will be alternately occupied by normal north-east trades, and by a deflected south-west extension of the normal south-east trades; while the other will be occupied by alternating south-east and north-west winds. These may be called the northern and southern equatorial belts.

The reversing winds of the subequatorial belts may be called the terrestrial monsoons. They are beautifully developed in the southern subequatorial belt of the Indian Ocean, and less perfectly in the northern subequatorial belt of the Pacific Ocean. The monsoons of the northern subequatorial belt in the Indian Ocean are exaggerated beyond the ordinary dimensions of the terrestrial monsoons on account of the encouragement given to the northward migration of the heat equator by the deserts of southern Asia.

Now if the terrestrial monsoons were strongly and systematically developed in every ocean, they might exert a seasonal influence on the surface-currents, producing an east-flowing movement of the surface-waters between the west-flowing greater currents that are driven by the normal trades. Such counter currents would necessarily lie a little to one side of the equator in the subequatorial belt; and they would necessarily vary with the seasons, occurring in the northern subequatorial belt during the late northern summer, and in the southern belt during the late southern summer. Hence the terrestrial system of wind-driven surface-currents would be characterised not only by faster motion in the winter, as stated above, but also by the development of a subequatorial counter current in the summer; just as the terrestrial system of winds is characterised not only by greater velocity in winter, but also by a reversal of normal direction in the subequatorial belt in summer.

Mode of classification, manner of presentation, and proportions of inductive and deductive treatment are largely matters of individual preference. During the progress of a study, as well as in the announcement of results, workers and writers follow their personal habits of thought, rather than yield to the guidance of any rigid scheme of procedure. To give examples from among our leading American meteorologists, the deductive habit of thought shown by Espy and still more by Ferrel, and the inductive habit shown by Redfield and Loomis, not only illustrate a striking contrast in methods, but also prove how valuable may be the results from either method, and how futile it would be to urge any worker to abandon his natural habit for another of supposed greater propriety. I make this quasi-philosophical excursion in order to avow my enjoyment of a deductive classification of the phenomena here considered.

Such a classification might have been premature when Dampier, about two hundred years ago, first recorded the fact that the alternating currents of the Indian Ocean change their direction a month later than the change in the monsoon winds; but to-day it seems to me rather dilatory to postpone to a future century a deductive classification that is already so well supported as that now gained regarding winds and currents. It is therefore my practice to present the deductive classification of the planetary and terrestrial winds and currents in college lectures, but at the same time to furnish abundant exhibition of facts on wind and current charts for laboratory study, and ultimately to justify the essential truth of the terrestrial system of movements in air and water by a consideration of the individual features of each oceanic area, to which we may now turn.

Owing primarily to the irregularity in the land enclosure of the five oceans, North and South Pacific, North and South Atlantic, and South Indian, the heat equator executes very uneven migrations about the geographic equator; and hence the subequatorial belts, with their monsoons and counter currents, are expectably of unequal development in the individual examples furnished us. The heat equator follows the sun north of the geographic equator in the North Pacific; but when the sun goes south, the heat equator crosses the line only in the western part of the South Pacific. The cool water brought by the Peruvian current from the far south, or from the up-welling along the windward part of the South American west coast, prevents a normal southward migration of the heat equator in the eastern part of this ocean, and indeed holds the heat equator north of the geographic equator all the year in the Galapagos region. The wind charts of the German *Seewarte* show a southern subequatorial monsoon belt only in the western part of this ocean, and there alone is a counter current found south of the Pacific equator, both these features being developed in the late southern summer. At this season the south-west monsoon of the northern subequatorial belt is extinguished except in the far east; and the counter current north of the equator is greatly enfeebled or even stopped under the generally established normal north-east trade, as has been shown by Puls in a recent number of the Archives of the German *Seewarte*. But in the northern summer all trace of the southern subequatorial belt disappears, and the northern subequatorial belt becomes relatively well established: the heat equator gaining a good northing, the winds behaving as if the south-east trades crossed the geographic equator and turned to the right of the pressure gradients there found: and the counter current flowing much broader and steadier than before. It should be noted, however, that the northern summer monsoon wind is not strongly developed in the middle longitudes; and that in the western part of the ocean it does not blow from the south-west at all, but is there held to the south or even south-east by the action of Asia in disarranging the normal terrestrial paths of isotherms and isobars. Here some other cause may operate to aid in the production of the counter current; but it still remains true that Pacific winds and the currents both show periodic variations that are appropriate to the subequatorial belts of the

terrestrial system, although deformed from symmetrical development by the individual features of the North and South Pacific.

In the Atlantic, the peculiar configuration of Africa and South America impose such an arrangement on the general currents that the heat equator is held north of the geographic equator at all seasons, except close to the American coast, when it enters the southern hemisphere in January and February. Hence no southern subequatorial belt is to be looked for here, and the monsoon wind and counter current of the northern subequatorial belt are not extinguished during the northern winter, but only show a diminution in strength and area. They are both well developed in August, but comparatively weak and of small extent in February; but they are never wholly extinguished.

In the Indian Ocean the southern subequatorial belt has a better development than in any other ocean; manifestly because no large volume of cool water is brought to the equator along the west coast of Australia. Here the charts for February exhibit the heat equator about ten degrees south of the geographic equator; a well-developed north-west monsoon of purely terrestrial origin, independent of assistance or hindrance from continents; and a distinct counter current. Meinardus has found evidence of a weakening or break in the north-east trade here on the equator, as if it did not blow steadily across the line and then by austral deflection swing around into the north-west monsoon; but whatever its method of procedure, the north-west wind and the counter current charted in this belt must be taken as remarkably good verifications of the subequatorial elements in the terrestrial system. At this time the north-east trade, or winter monsoon north of the equator, is driving the surface-waters westward, and the current there formed may be compared with the west-flowing equatorial members of the eddy currents in the other great oceans, the rest of the North Indian eddy being absent because Asia occupies its place.

When the sun goes north, the heat equator follows, and at last leaps far north on the deserts of Persia and India. An abnormally long extension is thus given to the northward pressure gradients, and the south-west monsoon developed on them is the most famous wind of its class in the world. The currents change in due time; the counter current south of the equator yields its place to the normal equatorial member of the South Indian eddy; the waters north of the equator flow eastward in proper counter current fashion over all the space from the geographic equator to the land.

To the student of commercial geography the plain facts about the winds and waters are thought to suffice. He does not care so much for their causes as for their consequences. For him, little need be said about the southern subequatorial belt of the Indian Ocean, for it is of relatively little importance to navigation; much more must be said about the winds and currents north of the equator, for they are larger and stronger, and have long been famous for their influence on man's ways of doing things. But to the student of physical geography, or physiography as it is coming to be called, the weak monsoon and the narrow counter current of the southern subequatorial belt are of almost

greater interest than their stronger relatives of the northern belt; for while the latter appear to depend on the neighbouring land for their existence, the former are seen to be purely a consequence of the oblique stand of the earth's axis, and thus to be related to the seasonal variations in length and strength of sunshine, and to the seasonal fluctuations of temperature, winds, and currents, of simply terrestrial origin, all over the globe. Where correlations of this kind enter a study, they are subject to a greater degree of error than prevails among simple inductions from direct observation; but when correlations are well established they certainly invest their subject with a degree of interest that cannot be approached by the mere accumulation of unexplained, unrelated facts. When correlations are carefully stated in their true light, as flighty speculations, possible hypotheses, or verified theories, they need not claim a greater measure of confidence than they deserve, and that measure may be made by each intelligent student for himself. It is in this way that I should like to have judgment passed on the correlations here suggested.

Among the other explanations of the equatorial counter currents is one that regards them as the reflux from the lands against which the equatorial currents impinge on the western side of the oceans. Abstractly considered, such a reflux is eminently possible; but as the cause of the actual counter currents, it is inadequate in various ways. It gives no sufficient reason for the peculiar position and seasonal occurrence of the several counter currents. It is curious that no reflux occurs anywhere but near the equator. A reflux might be expected where the east-flowing currents of the South Pacific impinge against South America, or where those of the North Atlantic press against Europe; but no counter currents are there found. It is very curious that the counter currents never occur just on the equator, but always a little way to one or the other side of it. It is doubly curious to find the so-called reflux periodically associated with a favouring periodic wind, and it is hardly possible to regard this association as a matter of chance. In the almost persistent counter current of the North Pacific, it is extremely difficult to understand how it can flow all across that broad ocean if it have no other cause than a rebound from Asia; it is no less difficult to understand why it should head so far to the west if it is wanted only to compensate a deficiency on the American shore, thousands of miles away to the east. Both reflux and compensation may have a share in producing it, but they fail to explain its periodic waxing and waning with a periodic wind. Neither compensation nor reflux are at all adequate to account for the counter currents of the South Pacific, the Atlantic, and the Indian Oceans. The deflective force of the earth's rotation, advocated by some as a means of turning branches of the main eddies into the path of the counter currents, very likely serves continually to reinforce them by small lateral contributions; but it must also serve to deplete them, for there is no good reason advanced to show that the deflective force alone would contribute more water than it withdraws. This force truly aids in maintaining the separation of the Labrador current from the extension of the Gulf Stream. It aids in

causing the currents from the Indian Ocean to return eastward just south of the Cape of Good Hope, instead of flowing up the west coast of Africa. Ferrel has given good reason for thinking that it controls the formation of the several sargasso seas within the oceanic eddies.[1] But the small value of the deflective force near the equator makes the subequatorial belts the least favourable position for currents thus originated that could be found anywhere in the world.

Altogether, the correlation of counter currents with monsoons, and the association of both with other features of the terrestrial system of atmospheric and oceanic circulation afford an explanation for them that is to me much more satisfying than any other that has been offered. As the facts are to-day reported, the counter currents seem to be so closely dependent on the monsoons, that they may be fairly included with a number of other relations found between wind and water, and all used together in support of the atmospheric control of the surface currents of the ocean.

The objections that have been urged against winds as the cause of ocean currents, on the ground that they are not strong enough to produce the observed effects, can hardly be accepted as valid in the face of the many correspondences discovered between the wind and water movements. The general correspondence urged by Croll is very striking; not the trade-winds only (to which many text-books give undue emphasis), but the prevailing westerlies also, and the branching winds by which the trades and the westerlies are connected over each ocean, all have a share in the result. Then the accordance of seasonal or terrestrial fluctuations in velocity and direction in atmosphere and oceans, as above stated, is extraordinarily suggestive of cause and effect. Furthermore, the irregular movement of surface currents during and for a short time after the irregular departure of storm winds from the path of the prevailing winds, can leave no doubt of the competence of winds to sweep the waters into motion; even the Gulf Stream has been observed to be blown aside from its average path, or to be temporarily reversed by storms. Finally, the immediately visible forward blowing of wave-tops by strong winds is the smallest and most apparent member of this long series of correspondences. Whatever other causes may contribute to the result, there can be little doubt that the surface currents are ruled by the winds.

Yet in spite of this conclusion in favour of Croll's contention, the slow equatorward creeping of the deep cold oceanic waters is best explained independent of the winds, as Carpenter would have had it. The temperature and composition of the deep water beneath the equator prove its movement from the polar seas, and in the equatorial Atlantic

[1] Ferrel showed that, on fair estimates of the velocity of an oceanic eddy, the centrifugal force arising from its curved motion is less than the centripetal force arising from its inward deflection; hence there must be a perpetual inward spiralling toward the centre of the eddies, and a slight accumulation of water about the centres. In consequence of this, there should be a slow down-settling of the central waters, leaving the sargasso, brought there by the spiral inflow, floating on the surface.

there are certain peculiarities in the distribution of bottom temperatures that are compatible only with a convectional circulation. The case may be stated as follows :—

On account of the configuration of Africa and South America, there is a continuous flow of South Atlantic surface water across the equator into the North Atlantic. The oblique cross-equator current that branches out from the South Atlantic eddy, and joins the North Atlantic eddy, always supplies the latter ocean at the expense of the former. There is no available place for a compensation return current but at some undetermined depth beneath the surface; only there can the North Atlantic give back to the South Atlantic the great volume of water that it receives at the surface. Hence if the cold water at the ocean bottom have no cause of movement but the wind-driven surface currents, it must move from north to south beneath the equator in the Atlantic, thus compensating for the observed surface movement from south to north.

On the other hand, if convection is the responsible cause of the bottom movement, it may be urged that a greater volume of cold water would move towards the Atlantic equator from the broad Antarctic than from the relatively narrow Arctic, and that the greater volume of bottom water coming from the Antarctic would continue its motion somewhat beyond the equator, from south to north. Thus directly opposite bottom movements would result from these rival causes; the surface winds producing one result; and oceanic convection, another. The facts soon decide as to which one of the movements really takes place. The temperatures of the equatorial Atlantic bottom are somewhat lower south of the equator than north of it; the difference is slight but critical. The isotherms on the bottom (as charted by the United States Hydrographic Office) are convex northward about the equator in each of the abysses on both sides of the medial ridge. Whatever movement takes place there must be northward, and this proclaims oceanic convection and not surface winds as the cause of the movement.

The chief objection to the convectional origin of the deep circulation has always been the very small value of its effective forces, as was repeatedly urged by Croll. But, as Ferrel has pointed out, the component of gravity that is there available is of the same order as the force by which the tides are produced; the latter acts intermittently and yet causes a tidal movement that is of sufficient value to produce very perceptible rise and fall of the waters when the mid-ocean wave is magnified by running on shore in the same way that swell is magnified as it is converted into surf. Hence the convectional force, acting persistently, may be accepted as competent to produce at least a very slow creeping. Considering both the testimony from the temperatures of the deep equatorial Atlantic and the similarity in the value of the tidal and convectional forces, it is difficult to withhold belief in the convectional origin of the equatorial-polar interchange. Considering the remarkable accordances that are discovered between the winds and the surface currents, it is even more difficult to doubt that the latter are caused by the former. Slight variations in density, due to differences of temperature or of salinity, or both, may cause one surface current to

dip beneath another, as is believed to be the case on a large scale where the cold but somewhat freshened Antarctic water broadly overflows the warmer but salter water in southern latitudes; or on a smaller scale as reported from the Arctic by Nansen; but these are only subordinate complications in the great surface circulation, and cannot be regarded as indicating that differences of density are its prime cause.

The sources from which the above statements of facts are drawn are chiefly as follows:—

The Atlases for the Atlantic, Pacific, and India Oceans, published by the German *Seewarte* at Hamburg.

Monthly Charts of meteorological data for the nine 10° squares of the Atlantic, etc. British Meteorological Office, London, 1876.

Currents and Surface Temperatures of the North Atlantic Ocean from the equator to latitude 40° north for each month of the year, constructed by R. Strachan under the direction of R. H. Scott; British Meteorological Office, London, 1872.

Monthly Charts of the North Pacific Ocean, compiled under the direction of Lieutenant J. A. Lyons, United States Hydrographic Office, Washington, 1878.

Three Cruises of the 'Blake,' A. Agassiz, Cambridge, Mass.

'Challenger' Report on Oceanic Circulation, by A. Buchan, 1895.

De Guinea en Equatoriaal Stroomen, Dutch Meteorological Institute, Utrecht, 1895.

Currents of the Equatorial Pacific, by Dr. C. Puls, Archives of the German *Seewarte*, xviii., 1895.

Various articles by Croll, Carpenter, Ferrel, Zöppritz, Krümmel, and others.

SCHOOL GEOGRAPHY IN THE UNITED STATES.

By Richard E. Dodge, Professor of Geography, Teachers' College, New York City, and Editor of the *Journal of School Geography*.

It is a well-accepted feeling among the teachers and educators of the United States that the subject of geography is the poorest-taught of any in the curriculum. Perhaps the words of the eminent student of pedagogical problems, Professor G. Stanley Hall, of Worcester, Mass., present this opinion most clearly when he speaks of geography teaching as "the most vexed and undefined problem of modern pedagogy." There has been a tremendous revival in the country within the last decade, which has caused an arousing of popular feeling among teachers as to the necessity of better geography work. As is the result of revivals usually, things have in some cases gone to extremes, for the educational papers present much that is useless and irrational, but which is accepted by the common-school teachers because it is labelled geography, and because they would think themselves behind the times should they neglect to accept anything which promises a change. Publishing houses are producing text-books which claim to be better than their predecessors at a rapid and astonishing rate; devices and methods, some of them new and

some of them old but clothed in new words, are extremely frequent and numerous. Indeed the average teacher is oppressed by the quantity of material which is at her disposal, but concerning which she is unable to make an estimate of value.

Geography has been a dead and not a live subject, and in the attempt to make it alive, oftentimes, the educators have stimulated the work without giving it permanent strength. What is needed above all else is the assistance of the scientists and of the university men who are making geography their specialty. A number are at present at work in the United States on this difficult and important problem; but there are many more whose sympathy and assistance have not yet been brought into line. The superintendents and teachers need the assistance of the scientists in the organisation of courses, in the selection of materials, and in the work of the training of teachers.

The first great move toward geographic improvement was that of a sub-committee or conference of the famous Committee of Ten, who published their recommendations of what geography in the school should be, in the report of the United States Commissioner of Education for 1892-1893, and more fully in a Bulletin of the Bureau of Education, entitled, "Reports of the Conferences arranged by the Committee on Secondary School Studies." The main points of the report on geography were as follows:—That the study of geography should be based fundamentally upon the physical features of a region, and so far as possible be carried on out of doors; that the teachers who intended to teach geography should be trained in the elementary principles of physical geography, meteorology, and geology; that the natural order of geographic subjects should be elementary geography, physical geography, physiography, meteorology, and geology, in that order through the elementary and secondary years; that observational geography should be foundational in the elementary school, its object being first, "to develop the power and habit of geographic observation; second, to give the pupils true and vivid basal ideas; and third, to arouse a spirit of inquiry and a thirst for geographical knowledge." Following observational geography, based upon the home locality, should be representative geography, in which maps should be made, and there should be training in the ability to understand maps. Later should come derivative or descriptive geography, in which the pupils should, from the maps and from their knowledge of the meaning of maps, work out the conditions of the earth's surface in any region. Finally, that the work should be carried on in a rational way, ever keeping the relation of cause and effect in mind. The Conference believed that a careful and detailed training of the teachers in geographic principles was more important than a knowledge of the pedagogic manner of presentation and of the later text-books. Though the recommendations were acknowledged to be ideal, and the ends not immediately possible, the effect of the report has been to produce a great deal of scientific and rational work in different parts of the country, and to arouse a feeling that physiography is foundational.

The report of the Committee of Ten was followed immediately by a pamphlet which has been of great service in bringing the teachers of the

country in touch with the governmental maps available for their purposes.[1] There was an immediate attempt on the part of the educators to begin the work of developing geographical education toward the ideals held out by the Committee of Ten, which was productive in the bringing forth in 1893-94 of the report of the so-called Committee of Fifteen.[2]

The essential points of the report of the Committee of Fifteen were that in elementary geography the commercial idea should be central, and that the understanding of the physical conditions of a region should not be attempted until the fifth or sixth year in school; that the geography should be "human rather than scientific." It is readily seen that this report offered a compromise between the existing conditions and the ideal conditions, and offered suggestions that would be more immediately available to the average teacher at the moment. In 1894, J. W. Redway[3] came out emphatically in an article decrying the methods hitherto followed in the training of teachers, and making a strong demand that physical maps be used more extensively and that the work in geography be more scientific. This article was soon followed by another, by the same author,[4] which was extremely helpful in suggesting points for the correlation of the geographic features of a region and its history, with particular reference to Rome, Greece, Asia Minor, and the vicinity of New York. In the following year the National Geographic Society of Washington, D.C., thinking the times favourable for the publication of physiographic papers for the use of teachers, issued through the American Book Company a series of ten Geographic Monographs. The individual papers in the series dealt with special fields by specialists, but were unfortunately not sufficiently simple to be of widespread use among the common teachers. Certain of the papers are, however, of great value to the pupil of physiography and to the trained teacher, and the series is one of the best helps for progressive teachers that has thus far appeared.

I have said that the report of the Committee of Fifteen called for "human rather than scientific geography," as if the two kinds could not be carried on together. I feel that the demand now is that geography be human *and* scientific; and that educators see no reason why geography work should not be carried on in a scientific way, and yet in such a manner as to bring forth the sympathies and understanding of the pupils, and to make it an inspiring and broadening subject even to elementary students. There are certain local centres in the United States from which emanate rapidly varied and very helpful suggestions as to how to train pupils to a scientific understanding of the relation of man to the earth. The universities of the country in which geography is becoming a live subject are having an ever increasing influence over the teachers, and are doing through their professors a great deal of good. In con-

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[1] *The Use of Governmental Maps in Schools.* Davis—King—Collie. Henry Holt and Co.

[2] *Report U.S. Commission of Education*, 1893-94, pp. 502-505.

[3] "The Status of Geography Teaching." *Educational Review*, June 1894, pp. 23-44.

[4] "Some Applications of Physiography to History." *Educational Review*, Nov. 1894, pp. 374-381.

sideration of this work, every one naturally turns first to the work being done by Professor William M. Davis of Harvard University, who was a member of the Conference on Geography of the Committee of Ten. Professor Davis is very emphatic in urging that home geography be made the foundation for observational geography, and in demanding better training for geography teachers. He believes that teachers should be trained in the underlying principles of geography that they may gain a scientific basis of classification of geographical forms and the ability to get geographical information first hand. His writings on this subject was most numerous and suggestive.[1] Professor Davies has also led in the work of bringing to the teachers a knowledge of their home localities, so that it would be most helpful to them. He recognises the fact that such help, which can be directly applied, is far better than a large number of suggestions incapable of immediate application. He has therefore attempted to reach the teachers by producing several pamphlets setting forth the materials available for illustrating the geographical features of the different states with suggestions as to their use.[2]

The first far-reaching attempt to apply the conceptions of modern physiography advocated by the Committee of Ten and Professor Davis, to the actual needs of the teachers, was that of Mr. Alexander E. Frye, who published a Primary Geography in 1894, and a Complete Geography in 1895. These books, published by Ginn and Company, gave much attention to the origin, development, and classification of land forms as a basis for continental study. The writer was assisted in his work by Professor Davis. The author who has done and is doing the most to push the claims of modern geography in the high schools, normal schools, and academies of the country is another student of Harvard, Professor Ralph S. Tarr of Cornell University, whose Elementary Physical Geography, Elementary Geology, and First Book of Physical Geography are well-known and most popular text-books. Professor Albert P. Brigham of Colgate University, Hamilton, N.Y., is also doing valuable work in bringing scientific methods to the minds of the teachers, particularly through lectures. He has as yet published but one paper directed toward this topic.[3] Professor I. C. Russell of the University of Michigan, Ann Arbor, Michigan, has already given the educational world three very

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[1] "The Teaching of Geography." *Educational Review*, May-June 1892.
"Geography in the Schools." *Educational Review*, 1893, pp. 327-339.
"The Importance of Geography Teaching." *National Geographic Magazine*, vol. v. pp. 68-75.
"Home Geography." *Journal of School Geography*, vol. i. pp. 2-6.

[2] *The State Map of Rhode Island as an Aid to the Study of Geography in Grammar and High Schools.* Rhode Island State Board of Education, 1896.
The State Map of Connecticut, etc. Connecticut State Board of Education, 1896.
The State Map of Massachusetts, etc. Massachusetts State Board of Education, 1895-96.
The State Map of New York, etc. Examination Bulletin 11, University of State of New York, Albany, 1897.

[3] *Syllabus of a Course of Five Lectures in Physical Geography for Cook County Teachers' Institute*, Chicago, Ill., 1896.

valuable readers[1] in geography of particular assistance to the progressive teachers, and of great interest to the lay reader, for their simplicity, their accuracy, and their completeness.

The result of this accentuation of the University influence in physical geography has perhaps been to put over-emphasis upon the use of physical principles as a necessary basis for the understanding of advanced geography in the common schools. There was a certain tendency among some teachers to grasp physical geography to such an extent as to eliminate more or less necessary descriptive and locational work in the study of political geography, they not being able, from their lack of a deep knowledge of geography, to combine the several branches of the science in the way they should be combined, and in the way the advocates of physical principles in teaching wished them to be combined.

In spite of all the advance that has been made, there is still a very great deal of what the report of the Committee of Fifteen has called "sailor geography" in the United States, in which the memorising rather than the reasoning powers are brought into play in the elementary years. This is illustrated by the fact that on one of the recent examination papers of the Regents of the University of the State of New York, who overlook and control the examinations throughout the schools of the State, there was a question asking for a list of the counties along the eastern border of the State. An article in the *Outlook*, March 6, 1897, p. 638, entitled "Infidelity and Geography," brings to mind most forcibly the conditions as they pertain in some of the Southern States. The article was but a series of comments concerning three letters received from a teacher in a Southern State, in which the writer states that he has been called an infidel for believing the earth to be *round*, and that it revolves around the sun. The local minister was to meet the writer in public debate on the question, and the inquirer asked for helpful references that would give him the matter necessary to prove his point. Not only in the Southern States, but in many parts of the country, the task of improving the geography work is made all the harder because the ignorant not only do not know but do not care to know.

On the whole, however, I think that the teachers and educators of the country are coming rapidly to perceive that home geography must become the basis for later training, as has been so long the habit in Germany, and to some extent in France. After a complete and causal understanding of the home geography, there is a feeling that the next step should be to a knowledge of the world as a whole, and particularly to a knowledge of the globe representation of the world, before maps are used. The link of connection between home geography and foreign geography should, of course, be some bond that will arouse the interest of the pupil, and the commercial or economic bond seems better capable of accomplishing this end perhaps than any other. The inter-relation of peoples, the dependence of one on another for soil products, manufactures, etc., at once leads to questions as to differences of conditions,

[1] *The Lakes of North America.* Ginn and Co., 1895. *The Glaciers of North America.* Ginn and Co., 1897. *The Volcanoes of North America.* The Macmillan Co., 1897.

allowing differences of occupations and products. The next step naturally is to a study of climate, and of the foundational determinants of geographical conditions in the different parts of the world. The child is aroused to interest through sympathy in this manner better than in any other that I know.

Throughout this study there should be an emphasis of the causal notion as to the why of things, and of the fact that man is present or absent in this or that region for particular reasons. After a study of the continents from a physical standpoint and in some detail, the course should be completed in the elementary schools by a comparative study of the continents.

During the geographic course there should be, of course, as close a correlation between geography, history, science, and literature as possible, and much work is now being done by teachers in an attempt to bring about rational correlation along these lines. The work of a few geographers who are emphasising the suggestions I have outlined above deserves to be noted here. W. B. Powell, Superintendent of Schools in Washington, D.C., has made particular progress in applying physical features to an understanding of the continents, and has written some helpful articles on geographical methods particularly applicable to a limited area.[1] Many manuals and pamphlets dealing with geographical methods to be followed throughout more or less complete courses have been published in the last few years. Mention should be made of a few that are suggestive from the pens of C. A. M'Murry,[2] Henry M'Cormick,[3] James A. Merrill,[4] F. M. M'Murry,[5] Charles R. Dryer,[6] and the writer.[7] An excellent article on physiography in the higher grammar grades, which is particularly helpful to those who follow the suggestions of the Report of the Committee of Ten, has recently been published by Robert H. Cornish of Morgan Park Academy, Chicago, Ill.[8] Within the last year have also appeared two series of text-books in this country, which have aroused a great deal of interest, and are being broadly used, because more helpful to the teacher not especially trained in the new geography than any others. These are the Primary and Advanced Geographies published by the Werner School Book Company, and written by Superintendent Tarbell of Providence, R.I.; and the Primary Natural Geography, soon to be followed by a more advanced book, published by the American Book Company, and written by Jacques W. Redway.

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1 "Geographic Instruction in Public Schools." *National Geographic Magazine*, vol. v. pp. 137-153.

2 "Geography as a School Subject." *Educational Review*, 1895, pp. 448-463.

3 "The Beginnings of Geography." *Public School Journal*, January-May 1897.

4 "A Course of Study in Geography, with Suggestions on its Application." *Report of the Public Schools of Missouri*, 1895, pp. 52-59.

5 "The Causal Notion in Geography." *Journal of School Geography*, vol. i. pp. 48-52.

6 "The New Geography." *Inland Educator*, February 1897.

7 "The Earth Sciences." *Science*, N.S., vol. v. pp. 502-504. Also, "Some Suggestions regarding Geography in Grade Schools." *Journal of School Geography*, vol. i. pp. 14-20.

8 "Laboratory Work in Elementary Physiography." *Journal of School Geography*, vol. i. Nos. 6 and 7.

Though the trend of all the work has been from memorising to reasoning, as I have before stated, but little emphasis has been paid to the development of scientific training as scientific training, through geography as a medium. There has been an attempt to make the work rational, but it has yet to be developed in the most logical way. Training of youthful children in the elements of scientific thinking is, as I know from experience, possible and profitable, and I trust that it will become more common in the near future. The three steps of observation, inference or prophecy, and proof, which are the steps to be followed by every scientific investigator, are possible in the early years, and if geography work is attempted along these lines, the pupils do better work later in their so-called true science, in their literature and their history.

The lines of advance that I have suggested above are not followed in the United States alone, and we teachers in the United States owe many suggestions to what has been published abroad. Among the helps that have come from Great Britain mention should be made of the recent articles from the pens of Messrs. B. B. Dickinson,[1] and A. J. Herbertson.[2]

We have yet in the United States to make our training scientific, to develop in the children the power of learning more, and the frame of mind that leads them to seek geographical information for themselves. Above all we have yet to train the pupils in a love for Nature; to become more accustomed to the excursion method of teaching geography; to make geography work not an isolated, but a related, part of the work of the school; and particularly to show the relationship between geography and history. These are some of the points to be borne in mind in further elaboration of the ends to be attained, if the conditions will allow. Before these ends can be secured, however, there are many things to be gained first. Particularly the teachers must be better trained, so that they may become geographical investigators, no matter how elementary. The geography teachers of to-day were taught in the old way, and have no basis for true and rich geography work. The conditions must be improved at once if the antique methods and knowledge are to be eliminated before the next generation of teachers are ready for their duties. Even those teachers, who are better equipped for their work than most of their fellows, often have to work with poor maps, and but very little equipment. School Boards give money for geographic equipment grudgingly, and think that aged and worn maps are sufficiently good, when they would be ashamed to have antique apparatus in physics or chemistry. Many teachers do not know of the aids at their service that can be procured for a small sum, or for nothing from the various Government bureaus that are continually producing helpful maps and other materials, in many cases especially for the use of

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[1] "Geography as a School Subject." (An attempt to show that Geography can be taught as a Training of the Mind.) Printed for the Geographical Association, 1896.

[2] "Geographical Education." *Scottish Geographical Magazine*, 1896, pp. 414-422, 22-528, and 576-583; also on "The Importance of Geography in Secondary Education, and he Training of Teachers therein." *Report of the Sixth International Geographical Congress.* John Murray, London, 1896, pp. 86-87.

teachers. Several geographers have within the last three years published articles setting forth the possible aids of this sort in some detail. Professor Davis published a list of lantern slides in 1893, chosen particularly to illustrate classes of land forms,[1] and has assisted greatly by the pamphlets previously mentioned. Other writers have published articles and bibliographies of considerable help, of which only a few can be noted.[2]

A great many of the pedagogical papers are publishing materials available for teachers, of which the Inland Publishing Company of Terre Haute, Indiana, has contributed one of the best helps this year.[3] This book is especially to be commended, as it is the first attempt to apply the principles of the new geography to the interpretation of the features of a state for the use of school teachers. It has led the way by an excellent example that should be followed in many states in the immediate future. The writer is attempting to help in the cause by publishing a "Journal of School Geography" for the common school teacher. Several references have been made to articles in this journal in the present paper.

I have attempted in this summary article to show some of the principles that underlie a conception of geography in the United States; to show the lines of advance, for advance it has been, which have been followed in the last decade, and to note what seems to me to be some of the weaknesses of the present system of school geography and some of the possible lines of growth for the future. The success of the good work which so many teachers are attempting depends, I believe, on our power to train teachers who are not superficial, and our ability to eliminate the idea that devices, striking extremes, and methods can take the place of knowledge. The geography teaching is improving rapidly throughout the northern and central parts of the United States, and much credit should be given the Universities and the Normal Schools for their work in bringing about the present conditions. The teachers are aroused to the necessity of improving and increasing their knowledge, and are seeking for help in a way that is most encouraging to those who feel the necessity of arousing public interest in the value of such a foundational subject in education as geography.

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[1] "List of Geography Lantern Slides." *Annual Report of the School Committee of Cambridge, Massachusetts*, 1893.

[2] R. S. Tarr: "The Teacher's Outfit in Geography." *School Review*, March-April, 1896.
Aaron Gove: *Syllabus of a Course in Geography.* Denver, Colorado.
The Writer: "Geography from Nature." *Bulletin of the American Geographical Society*, No. 2,1896. "Geographical Aids, I. and II." *Journal of School Geography*, vol. i. Nos. 2 and 6, 1897.

[3] Charles R. Dryer: *Studies in Indiana Geography.* 1897. Pp. 113.

THE MEETING OF THE BRITISH ASSOCIATION AT TORONTO, 1897.

By Lieut.-Colonel F. Bailey, (late) R.E., Secretary R.S.G.S.

The meeting, which was attended by 1362 members and associates, was held from the 18th to the 25th August. The reception-room and the meeting-rooms of the various sections were conveniently accommodated in the buildings of the Toronto University, which were remarkably well suited to the purpose. An unusual amount of rain had left the well-kept lawns beautifully green and fresh, and even at midday the temperature was cool and pleasant. During the afternoon of the 18th, the Mayor and Council formally welcomed the Association in presence of their Excellencies the Earl and Countess of Aberdeen, and in the evening the new President of the Association, Sir John Evans, delivered his address on "The Antiquity of Man," in the Massey Hall.

Next morning the section-rooms were occupied, and Dr. Scott Keltie, President of the Geographical Section, read the address, which was printed in the Society's *Magazine* for September. He was followed by Sir George Scott Robertson, K.C.S.I., on "Kafiristan and the Kafirs."

The paper, which was illustrated by lantern pictures, began with general remarks upon the geographical position of Kafiristan—the origin of the name, which means the Land of the Infidel *par excellence*, according to Mohammedan conceptions. Attention was then drawn to the dissimilarity this country bears to India in climate, vegetation, and in physical characteristics. Kafiristan was described as a highland region with a fairly equable temperature, in spite of great summer heat and heavy snowfall accompanied by severe cold in the winter. It is made up of an intricate network of mountain spurs and ridges, without roads, unless hillside tracks, impassable for horses, and even for dogs, in many places, may be so termed. The limited cultivable area is fairly productive. The scenery varies from tiny sloping fields and orchards, from luxurious tangles of wild vines and pomegranates to magnificent pine forests, according to altitude, but invariably includes a large view of profitless hillside and rock. Some of the higher elevations, where villages are to be found, are strangely bleak and inhospitable, and the people have a hard struggle to live. Of the inhabitants many interesting details were given, while their manners and habits were illustrated by a numerous series of lantern slides, made from photographs and drawings.[1]

Sir George Robertson's paper excited great interest, and the hall was filled with members who were desirous of seeing and hearing the "hero of Chitral." Sir John Evans, who was present, testified to the anthropological value of the pictures shown. Mr. Ravenstein then presented the Sixth Report of his Committee on the Climatology of Africa. (See "Geographical Notes" in the September number.)

Mr. Delmar Morgan read a paper on "Novaia Zemlia and its

[1] It is hoped that Sir George S. Robertson will address the Society during the coming Session.

Physical Geography,"[1] and in the absence of Mr. B. Leigh Smith, Dr. Mill briefly summarised the contents of the paper he was to have read on "Temperature Observations off Spitsbergen." This concluded the first day's work.

On Friday, 19th, the proceedings opened with an interesting paper by Professor R. E. Dodge, Professor of Geography, Teachers' College, New York.[2]

His paper was a plea for the assistance of geographers in the improvement of geography teaching in America, and particularly the United States. He pleaded for scientific geography based on a knowledge of the home conditions, urged that problems in geography be early introduced in the school work, that the pupils may be trained, not only in observation and inference, but in the proving of their inferences. He described the work in geography done by pupils of eight and nine years of age at the Teachers' College, New York City, the work being carried on by teachers not specially trained in geography.

After a discussion on Professor Dodge's paper, the President brought the Report of the Committee on Geographical Education to the notice of the meeting, and Colonel Bailey then read his paper on "Forestry in India."[3]

In early times, he said, the greater part of India was clothed with forest, but the areas not cleared for cultivation were for the most part denuded through over-cutting and over-grazing and burning, and by the destructive practice of clearing for temporary cultivation. He then outlined the efforts that had been taken by the Government of India since 1864 to improve matters, and the good results that had been obtained.

A discussion, in which Sir John Swinburne, Mr. Marcus Baker, of Washington, and several other gentlemen joined, followed the reading of Colonel Bailey's paper, after which Dr. Mill gave his "Scheme of Geographical Classification."

A classification of any branch of knowledge is necessary for the purpose of recording the several contributions of specialists, and the following scheme of geographical classification has been worked out practically during the elaboration of a subject catalogue of geographical literature. The essential primary division is into general and special geography. The former, which might equally well be termed pure or abstract geography, includes all general considerations which do not depend upon particular places; the latter reduces itself to an index of positions. It would be served most completely by employing latitudes and longitudes; but practically political subdivisions must be used.

The first principle in the classification of each great division is to group together facts of approximately the same order; thus, *e.g.*, we might take the continent as the first order of classification in the second division, the country as the second, and the province and county as the third and fourth. It would be fatal to the logical completeness of any scheme to mix up the three orders in one category. The number of orders to be adopted would depend to some extent on the detail required, but practically four would suffice, and in many cases three. A convenient notation would facilitate classification, and one is suggested in the paper whereby the various orders are distinguished by letters of different type and by numerals.

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[1] This paper will appear in the *Magazine*. [2] Do. [3] Do.

OUTLINE OF CLASSIFICATION.

GEOGRAPHY, GENERAL. [To the second order.]

MATHEMATICAL GEOGRAPHY in general :—
- Geodesy.
- Surveying.
- Cartography.
- Globes and models.
- Geographical instruments.

PHYSICAL GEOGRAPHY in general :—
- Geomorphology.
- Mountains in general.
- Earthquakes.
- Glaciers.
- Lakes.
- Rivers.
- Climatology.
- Oceanography.

BIO-GEOGRAPHY in general :—
- Distribution of plants.
- Distribution of animals.

ANTHROPO-GEOGRAPHY in general :—
- Ethnography.
- Historical geography.
- Political geography.
- Commercial geography.
- Geographical education.
- Place-names.
- Geographers' biographies.

GEOGRAPHY, SPECIAL. [Divisions of the first order only.]

- THE EARTH as a whole.
- THE LAND as a whole.
- EUROPE.
- ASIA.
- AUSTRALASIA.
- PACIFIC ISLANDS.
- AMERICA as a whole.
- NORTH AMERICA.
- CENTRAL AMERICA AND WEST INDIES.
- SOUTH AMERICA.
- AFRICA.
- POLAR REGIONS.
- THE OCEAN as a whole.
- ATLANTIC OCEAN (seas and islands as subordinate divisions).
- INDIAN OCEAN (seas and islands as subordinate divisions).
- PACIFIC OCEAN (seas only).
- SOUTHERN OCEAN.

Dr. Mill then read Mr. Vaughan Cornish's paper on "The Distribution of Detritus by the Sea."

The object of this investigation is to explain the processes which distribute the detritus that enters the sea at its margin. The processes can be deduced from the observed mode of occurrence of terrigenous materials on the foreshore and on the sea bottom, from the mode of occurrence of the rocks, from the motions of sea water, from the circumstances of attrition, from the behaviour of dust, and from the motions of individual pebbles and grains of sand.

The author deals in considerable detail with the motions of water due to tides and waves, and the transporting effects of these motions.

It is shown that the transport of fine mud downhill from the coast seawards is not due to the action of gravity.

Shoals and beaches (persisting structures of changing material) are dealt with in a manner similar to that employed by the author in the study of sand dunes (*Geographical Journal*, March 1897).

It is shown that the usual reasoning from the behaviour of individual pebbles and sand grains to the behaviour of beaches is vitiated by the neglect to take account of the fact that the variation in the proportion of the ingredients greatly exceeds the variation in the mobility of the individuals.

The paper will appear *in extenso* in the *Geographical Journal*.

The afternoon of Friday was occupied by Professor Milne's "On Certain Submarine Changes" (see "Geographical Notes" for October), and Mr. Ravenstein's paper on "The Congo and the Cape of Good Hope from 1482 to 1488," both with lantern illustrations.

In his paper on the Congo and the Cape of Good Hope from 1482 to 1486, Mr. Ravenstein said that

The discovery of the Congo and of the Cape of Good Hope constitutes two of the most interesting episodes in the history of geographical exploration. Apart from the legends on Behaim's globe, which must be accepted with caution, not a single original report by one of those who took part in these voyages has reached us, and hence the information given even in the best accredited histories of geographical exploration is erroneous in several important particulars. Recently, however, the inscriptions upon some of the columns set up by the early Portuguese navigators have been deciphered; several ancient manuscript maps have become available, and even one or two contemporary documents bearing upon the subject have seen the light. This enables us to give a more trustworthy account of these early voyages.

When King Alfonso died in 1481 the whole of the western coast of Africa, as far as Cape Catherine, had been discovered. King John, his successor, entered heart and soul into the business of exploration so successfully carried on by his ancestors. In 1482 (and not 1484) he despatched Diego Cao on his first voyage, which led to the discovery of the Congo and of the coast to the south of that river as far as lat. 13° 27′ S. After his return, on April 14, 1484, the explorer was knighted and figures of the two columns which he had erected were introduced into the coat of arms which was granted him. He set out again almost immediately, and succeeded in revealing the coast as far as Cape Cross, in lat. 21° 53′ S. If a legend on Germano's old chart can be trusted, he never returned from this expedition, but died near the last column erected by him. Martin Behaim claims to have commanded one of the ships of this expedition, and although it is possible that he was a member of it, he certainly did not play the important part as captain or "cosmographer" which he claimed. His reputation is based upon a globe the manufacture of which he superintended at the request of the town council of his native town, Nürnberg (1492), and a passage in Barros' *Asia*, which mentions him as a member of a Board of Mathematicians, instituted by King John to devise a method of determining latitudes by means of meridian altitudes of the sun. This, however, is all a myth. Long before the time of Behaim, and even before Regiomontanus, his alleged teacher, such tables had been prepared by Zacuto, a learned Spanish Jew, and these tables, as also the astrolabe, were in use among Portuguese mariners long before Behaim first came to Lisbon in 1484, and there is no reason to assume that Behaim ever took an interest in scientific work. His globe shows that he was thoroughly incompetent, for in laying down the part of the coast which he claims to have personally visited he errs to the extent of twenty-four degrees in latitude.

In 1486 an expedition from Benin brought news that there resided, at a considerable distance in the interior, a powerful Christian king, who was at once identified with "Prester John" of Abyssinia. King John forthwith despatched two expeditions, both of which started in 1487, the one, including Paiva and Covilhao, by land, the other, under Bartholomew Dias, by sea. Covilhao reached India, journeyed along the east coast of Africa as far south as Sofala, and ultimately entered Prester John's country. Dias doubled the Cape of Good Hope, probably

at the beginning of 1488, and followed the coast as far as the Great Fish river, when his crews insisted on being taken home. Thus the possibility of reaching India by sailing all round Africa had been demonstrated, and the realisation of the far-reaching plans of Henry the Navigator only became a question of time.

At the conclusion of Friday's meeting the Section adjourned until Monday the 23rd, when the first paper was one by Mr. Marcus Baker, Vice-President of the American Geographical Society, on "Institutions Engaged in Geographical Work in the United States." He sketched the geographical characteristics of the States, and mentioned the agencies through which information on the subject had been compiled. Then followed an interesting account of the geographical work of the United States Coast and Geodetic Survey, prepared jointly by Mr. T. C. Mendenhall, President of the Worcester Polytechnic Institute and formerly Superintendent of the Coast and Geodetic Survey, and Mr. H. Tillmann, assistant in charge of the office of the Survey. In the absence of Mr. F. H. Newell, of the Geological Survey, Washington, his paper on "The Hydrography of the United States" was read by General Greely. Professor W. Morris Davis read a particularly interesting paper on "The Coastal Plain of Maine," and Mr. G. E. Lumsden dealt with "The Unification of Time at Sea." The first paper of the afternoon was an extremely interesting one on "The Barren Lands of Canada," by Mr. J. B. Tyrrell;[1] it was illustrated by numerous lantern slides prepared from photographs. The author said that

> In general character the country is a vast undulating, stony plain, thinly covered with short grass, while rounded rocky hills rise here and there through the stony clay. It can be divided into two fairly distinct portions, viz., the "Coastal Plain," which rose from beneath the ocean in post-Glacial times, and the "Interior Upland," with a somewhat more pronounced topography, just as it was left at the close of the glacial epoch. The whole country slopes gently towards the north-east, and the three main streams which drain it have a more or less parallel course in that direction. These streams are the Back or Great Fish river, with a total length of 650 miles; the Telzoa or Doobaunt river, with a length of 750 miles; and the Kazan river, with a length of about 490 miles.

Mr. J. White read an interesting paper on "The Geographical Work of the Canadian Geological Survey from its inception in 1841 to the present time":—

> In the absence of anything like a general geodetic survey of the Dominion the Geological Survey, as the only organisation charged with the mapping of the country as a whole, has been forced to undertake extensive surveys and explorations. The operations in the field may be divided under two heads:— 1) The reconnaissance and exploratory surveys of the unexplored and the less accessible areas of Northern and Western Canada; (2) The detailed surveys, for mapping on regular scales, of the more accessible and the settled portions.

Mr. Charles D. Walcott contributed an account of the similar work accomplished by the United States Geological Survey, and Professor Willis L. Moore read an instructive and entertaining paper on "The

[1] This paper will appear in the *Magazine*.

Climatology of the United States." This closed the proceedings of a day devoted to United States and Canadian papers, all of which were of great value and interest. Dr. Mill acknowledged the generosity displayed by the Government of the United States in the distribution of the reports prepared by their Geological Survey.

The first paper on Tuesday, 24th August, was one by Mr. F. C. Selous on "The Economic Geography of Rhodesia." The members of the Economics Section were present in considerable numbers, and the hall was well filled to hear the great South African explorer and hunter, whose paper appears in the present number of the *Magazine*. When Mr. Selous had concluded, the Rt. Hon. James Bryce, M.P., who had himself travelled through the same country less than two years ago, bore testimony to the accuracy of the descriptions given by the author. Mr. J. T. Myres then read an account of a journey made by him in Tripoli, and Prince Krapotkin gave an interesting exposition of "The Lines of Structure in Eurasia," explaining the correlation of the main geographical features of the Old World. Professor Penck then offered a few brief remarks on "Potamology" as a branch of geography, urging that rivers play so important a part that they are entitled as much as oceans and lakes to be studies separately, and to have a special "Ology" all to themselves. A paper by Mr. E. L. Corthell on "The Geographical Development of the Lower Mississippi" was then read by Mr. M'Gee.

In the afternoon Mr. Otto J. Klotz read his paper on "South-Eastern Alaska: Geography and the Camera," showing how he had conducted topographical surveys by means of the photographic camera, and exhibiting the results in some beautifully drawn maps. Professor H. B. Dixon followed with an account of "The First Ascent of Mount Lefroy and Mount Aberdeen," and Mr. O. H. Howarth read his paper on "Mexico Felix and Mexico Deserta." (See "Geographical Notes" for October.)

The final meeting of the Section was held on Wednesday, August 28, when General Greely read a most interesting paper by Mr. Henry Gannett on "The Historical Conditions and Growth of the United States." Numerous diagrams were shown on the screen. Dr. Mill then addressed the Section on "Geographical Pictures," with lantern illustrations.

In view of the prominent place now taken by photography in the work of all travellers it is necessary to urge the importance of taking pictures which are geographically as well as photographically "good." Such pictures must be truthful and representative, the utmost care being taken to avoid distortion, to supply some indication of scale, and to bring out the characteristic features. General views comprehending a considerable area are desirable for showing types of land-forms or sites of towns. Pictures on a larger scale are desirable for showing the detail of special features, such as varieties of architecture, means of transport, or agricultural processes related to certain geographical conditions. As far as possible every geographical picture should show something distinctly illustrative of a natural feature or a local condition peculiar to the place where it was made, or at least characteristic of it. The handsomest house in a village, the rarest foreign tree in a park, or the prettiest view in a district, represents the sort of subject most often photographed, and they are precisely those of least geographical value. The paper was illustrated by numerous lantern views of typical scenery, people, and processes of geographical significance.

Professor Penck subsequently showed a number of excellent Geographical Wall Pictures, the use of which he advocated for the teaching of geography; and the work of the Section was brought to a close by an address from Professor W. M. Davis advocating that Geography should be made a University subject.

The Toronto meeting has been a most successful one, and the value and interest of the papers read in the Geographical Section have rarely been exceeded.

Crowded evening meetings were addressed on Friday by Professor Roberts-Austen on "Canada's Metals," and on Monday by Professor Milne on "Earthquakes and Volcanoes."

In addition to work in the meeting-room, a most attractive programme of excursions was organised by the Local Committee, including visits to Niagara, the Muskoka region, Parry Sound, Ottawa, Kingston, Montreal, Algonquin Park, and other places. A special excursion to Vancouver left Toronto in four detachments shortly after the final meeting of the Association. Numerous garden parties, given by hospitable Canadians, occupied the afternoons. Their Excellencies the Governor-General and Lady Aberdeen gave a reception to which all members and associates were invited; a banquet was given in honour of Lord Kelvin, Lord Lister, and Sir John Evans, and altogether the time passed at Toronto was extremely busy, delightful, and profitable.

THE MAPPING OF PLANT ASSOCIATIONS.

By Andrew J. Herbertson, F.R.S.E., F.R.G.S.

Everybody who has studied maps of plant distribution finds, as a rule, nothing but a series of lines marking the limits, usually of many species of different orders, crossing and recrossing each other in almost inextricable confusion. Even in the admirable compendium of botanical topography, Dr. Drude's *Pflanzenverbreitung* in Berghaus' Atlas, some of the maps are rendered almost undecipherable without a magnifying glass and much patience, owing to the amount of detail crammed into them. For the geographer something more is needed. He does not want the exact limits of every species of living plant charted, any more than he desires maps for every species of fossil; he requires maps of botanical associations just as he has at his service maps of geological formations.

The geological map is a synthetic chart conveying an immense amount of information to the trained reader—each different formation telling of different structure and different fossils bespeaking different conditions of origin. The botanical map should do the same—to the student it should indicate different floral types, depending on different physical conditions.

How are we to distinguish the different floral associations?

In the floral associations it is just as essential to find out what are

the typical and non-typical species as it is necessary to distinguish between the characteristic and non-characteristic fossils in the different geological formations. This is a work involving no little research as well as much discrimination.

The results of the geologists' investigations carried out in this way have proved of immense service to the geographer, especially in his study of the physical configuration of the earth; and there is every reason to believe that similar work carried out by competent botanists for plant-life will be of equally great value to the geographer, more particularly to the student of economic geography.

The practical value of such floral maps can hardly be exaggerated. Wherever man wishes to cultivate the ground a study of its actual flora is the most reliable guide to the possibilities of success or failure of new species. Each natural floral area has its special diathesis, and only plants whose diatheses are analogous can flourish in these areas. How much waste of money and time might have been saved to settlers in most of our colonies if a systematic floral survey had been made; and how much might still be saved by doing this!

It may be urged that climatic maps would do as well, as climate is one of the chief determinants of plant distribution. But climatic data are too scanty for this purpose; and little beyond very general deductions can be made from the ordinary climate maps. For the small-scale maps of an ordinary atlas the climatic data may suffice. For a map of 1 : 1,000,000, even of Scotland, the number of meteorological stations is quite inadequate, especially in the hilly parts of the country where they are most needed. If the climatic conditions of this country are so imperfectly known from the botanist's point of view, how much more is this the case in many of our colonies where meteorological observations, except at a few coastal towns, have been begun only within the past few years.

But in the flora of a region we have a climate guide, difficult to read at first, because we lack the meteorological data to correlate climate and flora, and because the influence of the soil and drainage is a very important factor in plant distribution. Although this factor embarrasses the theoretical climatologist, it is one which the agriculturalist must necessarily take into consideration; and to him, therefore, the characteristics of floral areas are better guides than those of climate alone.

In our own country the study of the distribution of plant associations is a necessary preliminary to the successful working out of the pressing problems of reforestation. In some parts of our colonies and of the United States the question of replanting the forests, that have been or are being recklessly destroyed, is also an urgent one. The study of plant associations is of even greater consequence in the unoccupied or only partially occupied regions of the globe, as a knowledge of their nature and distribution would prevent many costly experiments doomed to be failures. The colonies find it pays to spend much money on mineralogical surveys and maps. They would find it even more satisfactory to do the same for plant associations. Then good farmers would be readier to settle in new regions, and those with money to invest would not hesitate

so much to help colonial agricultural enterprises which could show reasonable prospects of success.

One of the duties of all agricultural stations should be the discovery of the cultivated plants that can be successfully grown in the regions of different natural floral associations. Experiments with such cultivated plants can then be carried on in the regions of the favourable floral associations with some hope of success.

The criteria distinguishing one floral association from another must be settled by experts in plant distribution, as those for geological formations have been by geologists. They can be settled only by practical study in the field, where all the conditions of their life can be observed at the same time, for neither botanical nor geological distributions can be studied merely from herbarium or museum collections, indispensable as these are to botanist or geologist.

There are many difficulties to be overcome. The choice of typical species is not an easy one, and the tracing of their distribution is a difficult task. For instance, in a settled region the cultures of men have masked their natural distribution, and often a close study of a region reveals the fact that it would have been better for man had they not done so. Again, one side of a valley may belong to one association and the other to another, and if the valley curves acutely these may be interchanged, and mapping becomes very complicated.

Suppose the botanist has determined the characteristics of the chief botanical associations, the geographer is eager to learn how the limits of each are to be traced and their distribution mapped. There is then the further question of the notation to be adopted on the maps. The mapping should clearly indicate the boundaries of the floral areas and permit the ready comparison of the botanical map with those of other natural conditions, so that all may be correlated and interpreted.

We therefore welcome the paper by Professor Flahault of Montpellier in the July number (1897) of the *Annales de Géographie*, called *Essai d'une carte botanique et forestière de la France*, as one of the most important of recent contributions to botanical geography. Professor Flahault is known among botanists as one of the most learned and able of their number; and every botanical paper he produces is characterised by minute observation, clear comprehension, masterly interpretation, and lucid exposition. Of his special fitness to undertake the work of distinguishing between the different floral associations in France there can be no question. The discussion in detail of this part of his work must be left to botanical experts in their journals. Here we have to do with Professor Flahault as a geographer.

As a botanical geographer, Dr. Flahault has travelled from the far north in Sweden to the Sahara in Algeria, while for the purposes of his botanical survey of France he has walked many thousand miles, and mapped the limits of the different plant associations on the 1 : 80,000 map. The area surveyed in this way, during the last few years, is over 120,000 square kilomètres (45,000 square miles), and, indeed, every minute that could be spared from professional duties at Montpellier has been spent in this work since it was first undertaken.

As a sample of his methods and results, Professor Flahault has published one of the thirteen sheets, now ready, on a scale of 1 : 200,000. This sheet, the floral map of the Perpignan region, has been chosen as perhaps the most complicated of any, for it embraces five great natural regions. First, the littoral flora—the salt-loving plants that flourish along the coast of the Mediterranean. Second, the evergreen flora of the Mediterranean, with the evergreen oak (*Quercus ilex*) as a typical species, mixed with the cork oak (*Q. suber*) in Roussillon and the Narbonnaise. Third, the deciduous forests of temperate regions, willows and poplars forming the river woods, *Phragmites* and *Alismaceæ* in the lagoons, marshes, and irrigated meadows of the plain, and with the oak (*Q. sessiliflora*) on the plains, and also on the lower hills, where the chestnut grows (*Castanea vesca*); while on the slopes of the Pyrenees these are replaced by the beech (*Fagus sylvatica*) and spruce (*Abies pectinata*). The fourth natural region is the sub-Alpine area of resinous trees, such as the Scots fir (*Pinus sylvestris*) and the mountain pine (*P. uncinata*); and higher up the mountains, above 2000 to 2300 mètres, is a fifth area of continuous pasture, the Alpine region of gentians, *Swertia perennis*, and *Saxifraga oppositifolia*.

Professor Flahault gives a brief account of these associations of plants and the conditions in which they are found, reserving details for the botanical memoirs.

A very beautiful map, which is the most important part of the communication, shows the distribution of twelve typical associations. The region where the maritime pine (*Pinus pinaster*) grows is distinguished from the rest of the littoral region; the Mediterranean region is illustrated by the distribution of the evergreen and cork oaks and the *Pinus laricio*; the Temperate Forests by oak, chestnut, beech, and spruce, while the Scots and mountain pines represent the sub-Alpine associations.

Professor Flahault asks for criticisms on the map. For the geographer, the guiding principle in making such a map should be to emphasise the primary natural areas, and to show the subdivisions of these areas in a less obvious, yet still distinct, manner. The best way to accomplish this is to chose a different colour for each great area, and to use various tints and shades of it to bring out the minor areas. For ease in interpretation the sequence of colours chosen should be that in the spectrum. In the case of vegetation maps, warm reds should be selected for the floras of hot regions, and cold blues and violets for sub-Alpine, Alpine, sub-Arctic, and Arctic floras. Such a scheme of colouring affords a graphic guide, not merely to the distribution of floral areas, but, at the same time, to the great climatic regions.

To a certain extent Professor Flahault has adopted this order of colours in his map, but he has allowed the botanist to get the better of the geographer, for he has emphasised too much the different associations composing each natural floral region, and consequently these five great regions do not stand out so distinctly on the map of the Perpignan region as they should have done. The botanist, too, is responsible for tinting the distribution of all pines, whether the maritime or mountain species, in shades of blue. The attempt to give a certain uniformity to the coni-

ferous areas might have been successfully accomplished by simply using a slight cross ruling of blue over the special colour of the great natural regions, which was not strong enough to annihilate the ground colour. In the case of the sub-Alpine region, where Scots and mountain pine both occur, this could also be done for one species, or a stipple of blue used for one species and solid blue for the other.

The map is open to criticism in the regions where two of the typical species are found. The device adopted is to show such regions by parallel bands alternately coloured by the tints of the one and of the other species. This is certainly preferable to introducing coloured lines tracing the limits of one species and colouring the whole area the tint of the other species. It is, however, hardly satisfactory on such a large-scale map, although on a smaller scale it is the only alternative. As it often happens that one species is found on one side of a valley and the other species on the other, it should have been quite possible to illustrate this in many cases on the 1 : 200,000 map. Where this was not possible, or where there was an actual mixing of the species, the tint of the predominant one might have formed the solid colour, while dots might have shown the distribution of the other species, the dots varying in closeness, and perhaps also in size, with the abundance of the second species. Such a device is at once more graphic and accurate than the one adopted, even where the thickness of the band is made proportional to the relative abundance of the species it represents, which always conveys a confused impression, and should be used only when the other is quite impracticable.

On such a map, too, with the colours for the five great natural regions quite distinct, more detail might have been shown within each region. This is true more particularly of the plain. It is a pity that the actually cultivated areas were not shown (by using a lighter or darker impression —stipple instead of solid, or *vice versa*). Although this might not increase the scientific value of the map, it would not have impaired it, when carried out in the manner here suggested, and it would have added greatly to its economic and historic value. The essential matter, however, in such a map is that the general be obvious at a glance. A limit must be set to details as soon as they begin to interfere with the clearness of the representation of the great natural areas.

Similar work should be done in the British Isles where questions of reforesting and of changes in agricultural products are of immense importance at the present day. Mr. Robert Smith, B.Sc., Demonstrator in Botany, University College, Dundee, a pupil of Professor Flahault, has begun to map the floral associations of Scotland, and has two or three sheets nearly ready; but the practical urgency and value of the work demands, not merely the spare moments of an individual worker, but rather the united efforts of the staff of a national survey.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Anniversary Meetings will be held in Edinburgh on Tuesday 9th, in Glasgow on Wednesday 10th, in Dundee on Thursday 11th, and in Aberdeen on Friday 12th *November*. At these meetings Mrs. I. L. Bishop will give an account of her recent journey to "The Chinese Far West."

GEOGRAPHICAL NOTES.

By Andrew J. Herbertson, F.R.S.E., F.R.G.S.

EUROPE.

Movements of the Waters of Loch Fyne.—Last year Dr. Mill went two trips in the *Garland* to make observations on the temperature, salinity, and movements of the waters of Loch Fyne. In his classical monograph on the Clyde Sea Area, he has already done much to elucidate the hydrographical conditions of this portion of it. The observations made at the beginning of April and September 1896, about the time of minimum and maximum temperatures, permitted a comparison with previous work, and a fuller interpretation of the movements of the waters. A preliminary discussion of these observations is published in the *Fifteenth Annual Report of the Fishery Board for Scotland*, at the conclusion of which, Dr. Mill summarises the results as follows:

"The flood-tide brings in water from the upper and deeper layers of the Arran Basin, which is thoroughly mixed in passing Otter Spit before high water, and fills the Gortans Basin with a nearly homothermic mass, which is passed on through the Minard Narrows into the Upper Basin, where it does not sink through the cold deep water in summer, but mixes only with the upper layers above 20 fathoms, becoming more superficial in its effects as the tide passes upwards. In the ebb there is, at the upper end of the loch, only a superficial movement, but at the platform between Furnace and Minard, the rush of the surface current into the Gortans Basin, while it is strongest at half-ebb, draws up the deep, cold layers to a slight extent, causing a slight mixture with the warmer waters. The homothermic mass pours out into the Arran Basin, acting on the ebb probably in the same way as at Furnace or the flood. Thus there is always in progress a gentle mingling of the deep waters of the two deep basins throughout the intermediate shallow basin. The rapid surface current of the ebb carries out the excess of fresh water from the Upper Basin, while the small underflow from the Arran Basin passes in water of higher salinity with the flood. This circulation is liable to be accelerated or checked by the influence of the wind."

Recent Hydrographical Work North of Scotland.—In the *Fifteenth Annual Report of the Fishery Board for Scotland*, Mr. H. N. Dickson discusses the observations made by the officers of H.M.S. *Research* in August 1896, in the Færoe-Shetland Channel. This is a continuation of the British section of the work of the international physical survey of the North Sea and North Atlantic, which has already yielded such valuable results. We need merely remind members of Mr. Dickson's papers on his observations in the Twelfth Fishery Board Report, and on the "Movements of the Surface Waters of the North Sea" (*Geographical Journal*, March 1896), and of Professor Petterssen's papers published in this *Magazine*, and his recent discussion of the relationship between hydrographical

and meteorological conditions (*Meteorologische Zeitschrift*, August 1896.—See *S.G.M.*, *Geographical Notes*, January 1897).

In August 1896 the lines of equal temperatures ran WNW., ESE. to 200 fathoms, and those of equal salinities were almost at right angles to them. Below 300 fathoms both isotherms and isohalines followed the contours of the Færoe-Shetland Channel, which is separated from the Atlantic by the Wyville-Thomson Ridge, rising to 300 fathoms below sea-level, the axis of greatest salinity lying more in the centre of the channel than that of lowest temperatures. Compared with former observations, the surface water was fresher near and west of the Orkney and Shetland Islands, and salter west and south-west of the Færoes. The surface water of the whole Norwegian Sea was exceptionally low in the summer of 1896; and Mr. Dickson points out that the northerly winds prevailed over Western Europe in the last quarter of 1896, and therefore high pressure over the Norwegian Sea; and this almost certainly kept the North Sea full of oceanic water at a fairly high temperature, and conditioned an open and rainy autumn and early winter.

Mr. Dickson's report was written before the data collected by other nations was available; so we look forward with interest to the continuation of his studies. These seem to promise most valuable results in explaining the movements of waters around our coasts, which will be of great use to the fishing community. Of even greater economic importance, as it affects every farmer in these islands, is the possibility of forecasting the average weather of a season through an accurate knowledge of the conditions of the North and Norwegian Seas and the North Atlantic Ocean, which is also foreshadowed in this recent hydrographical work.

AFRICA.

Dutch Plantations in the French Congo.—A brief account of the work of a Dutch company which owns several plantations in the French Congo is given in *Le Mouvement Géographique* for August 15. Mr. Wisser, who is director of the plantations, began by making a garden for himself at Cayo, near the Loeme. Round this two plantations have grown so successfully that others have been laid out on the banks of the Kuilu. Coffee, cacaos, and caoutchouc are the chief products. Indigenous coffee (*Coffea stenophylla*?) does best in French Congo. Liberian coffee can be successfully grown in good soil, but fears are entertained of its being susceptible to disease, and it is difficult to prepare afterwards. The *Coffea arabica*, from St. Thomas, is too delicate to be cultivated here. Cacaos grows well. The crop in 1896 was 25,000 kilogrammes of indigenous coffee-beans, 7500 of Liberian, and 5000 of St. Thomas; 13,500 kilogrammes of cacao. Over 10,000 caoutchouc plants have been distributed among the chiefs of neighbouring villages, and are doing well. There is an increasing demand from these villages and more distant ones for caoutchouc-trees. Nearly two hundred men are employed on the plantations, but there is a scarcity of labour, as the capable men are taken away from the villages to act as porters in the caravans.

AMERICA.

Mexico Felix and Mexico Deserta.—The physical structure of the region comprised in the Mexican Republic, viz., that of a high plateau of some 550,000 square miles in area, fringed by a narrow belt of low-lying lands on either coast, has led to its being usually described under three climatic divisions—the Tierra Caliente, or Hot Lands, the Tierra Templada, or Temperate Lands, and the Tierra Fria, or

Cold Lands. For practical purposes such a description can hardly be said to afford any strict geographical definition, inasmuch as the climatic conditions of any particular locality are not dependent only on temperature, but also on altitude, rainfall, evaporation, forest growth, proximity of ocean waters, and other modifying causes, all of which operate in varying degrees at different latitudes. Omitting the coast levels, which are essentially tropical in character, though not wholly within the tropical limits, and the higher mountain ranges of the interior, it is to be observed that the general characteristics of that portion of Central America are still subject to much misapprehension in the minds of those unacquainted with Mexico. Regarding the conditions of human life and prosperity, it occurs to me that the general distinction into "Mexico Felix" and "Mexico Deserta" is somewhat more to the purpose: and it will be seen that those conditions have little to do with mere temperature by itself—still less with actual latitude.

From a breadth of some 1200 miles at the United States frontier, on about the 30th parallel, the continent narrows gradually throughout its south-easterly trend to one of only 120 miles at the Isthmus of Tehuantepec, widening again at the borders of Guatemala, some 14 degrees farther south, before it contracts finally to a 45-mile strip at Panama. From the general altitude of 3000 to 4000 feet, extending through the south of Arizona, New Mexico, and Texas (U.S.A.), there is a further gradual rise beyond the course of the Rio Grande, and a general level of 5000 feet and upwards is maintained for 1200 miles, until, south of the city of Mexico, it declines again by a series of terraces to under 2000 feet, mounting up once more in the States of Oaxaca, Guerrero, and Chiapas. Yet the mean temperatures and evaporation are considerably higher, and the rainfall lower, in the northern portion of this tract than in the south, which is commonly supposed to belong to the torrid regions of the earth. While the mean temperature during last year in the city of Mexico was slightly under 60° (Fahr.), that of Monterey, in the State of Nuevo Leon, was over 74°; whereas at the city of Oaxaca, 300 miles farther south than Mexico City, and at 2000 feet less elevation, it was no more than 67°. The northern States of Chihuahua, Coahuila, and Nuevo Leon preserve largely the characteristics of Nevada and Arizona, comprising vast arid plains of sage-brush, mosquite, and cactus, intersected by treeless mountain ranges, and forming a zone between the regions of winter and summer rains upon which the latter intrude but sparsely and only in occasional seasons. Hence it is that in the southern States of North America the higher rainfall, together with the altitude and approximation of the oceans, has developed a climate both healthier and more equable, and a vegetation which in the north is only found in patches or amongst the heights of the coast ranges.

Perhaps the evidences of this peculiarity which possess the most direct interest for us are those bearing upon the population of these southern regions in remote ages, the study of which is rapidly leading us to assign to them an antiquity at least as great as any of which the world holds any record.—*Mr. O. H. Howarth's Abstract of his Paper read to the British Association, Toronto.*

Rainfall in Central America.—Dr. Karl Sapper, who has so energetically promoted the making of rainfall observations among the coffee planters, especially in the Guatemalan province of Alta Verapaz, gives valuable tables of the monthly and annual rainfall of the northern part of Central America in *Petermanns Mittcilungen*, vi., 1897. This supplements Professor Harrington's paper on Central American Rainfall (*Bull. Phil. Soc. Washington*, xiii., pp. 1-30) which appeared two years ago, and allows a more accurate idea to be formed of the peculiarities of the precipitation in these regions.

Over the whole of Central America the Atlantic slope receives far heavier rains than the Pacific slope. The maximum is round Greytown. In the north much rain, in some places over 120 inches per annum, falls on the northern and north-eastern slopes of the mountain chains in Chiapa, Guatemala, and British Honduras, and also on the southern slopes of the highlands of Chiapa and Guatemala. More moderate rain is experienced in the regions bordering the foot of these mountains, and the climate becomes drier farther north in Yucatan, but the driest regions in the northern part of Central America lies in the valleys between the northern chain and the southern highlands of Guatemala, and on the south side of the isthmus of Tehuantepec as well as in northern San Salvador. The girdle of maximum rainfall appears to be at an average elevation of about 3000 feet above sea-level.

The north-east trade winds bring rain to the slopes against which they strike, and leave the western region dry during the winter months. The west receives rain only in summer when the equatorial rain-belt reaches so far north. In the northern region round Alta Verapaz, however, N., NW., and even W. winds blow in the winter months and bring rain; and this northern part of Central America is also affected by rains due to cyclonic disturbances in the West Indies.

AUSTRALASIA.

British New Guinea.—Sir William Macgregor's *Annual Report* for 1895-96 marks another year of energetic and fruitful work in this colony. Two rivers, the Kumusi and the Mambare were inspected as far as they were navigable for the steam-launch, and the Musa river further explored. On the latter a party of invading cannibals from Trafalgar Bay and Collingwood Bay tribes were encountered, chased, and captured, but not before some of the natives of the region had perished. An expedition against the Tugeri tribes who disturb the Dutch border was successfully carried out, and another to punish the murderers of a gold prospecting party. The chief exports are gold (1378 ounces, £4735 in 1895-96) and sandalwood (524 tons, £4035) and copra (381 tons, £2748). India-rubber collecting is increasing in importance; sponges are now obtained from the Conflict group of islets; wild ginger exists, and might be exported in greater quantities; the pearl fisheries have not been quite so productive. The exports were valued at £19,401, and the imports amounted to £34,521; while the local revenue from customs amounted to £6547. The year 1895-96 was exceptionally dry in the west. The rainfall from July to June was 32·15 ins. at Port Moresby, and 69·49 at Daru.

Distribution of Vertebrates in Victoria and Tasmania.—The mechanical barriers to the dispersion of land and fresh-water animals in these regions are the Bass Strait—affecting all wingless animals—and to a very slight extent the Dividing Range. The relation of the mountains to rainfall is of the greatest importance, however. The damp forests of the south-east have a different fauna from the dry steppes of the north-west. The species found in Tasmania are also found in the moist forest regions of Victoria, with few exceptions. The fish of Tasmania, while distinct from those of the Murray basin, are almost identical with those of Southern Victoria. There are the closest resemblances, therefore, between the animals of South-east Victoria and Tasmania. But there is "a marked distinctness, extending even to the genera, of the faunas of the north-west plains and the well-watered south-east hill and coast country." This, as Mr. A. H. S. Lucas points out (*Proc. Royal Society of Victoria*, ix., new series, pp. 34-53), shows that as far as zoological evidence is concerned the Bass Strait was formed *long after* the separation

of the forest and steppe faunas, after the streams had been stocked with existing fish, but before the dingo and most highly differentiated tree forms of animals reached Southern Victoria.

POLAR REGIONS.

Franz-Josef Land—Jackson-Harmsworth Expedition.—Captain Brown, in the *Windward*, made an even quicker passage to and from Franz-Josef Land this year than that which astonished people last year. Mr. Jackson and the other members of this expedition—Lieutenant Armitage, R.N.R., nautical astronomer; Dr. Koettlitz, geologist and medical officer; Mr. W. S. Bruce, naturalist; Messrs. Wilton and Heyward—arrived at Gravesend on September 3rd. Three years have been spent in exploring Franz-Josef Land. Accounts of the first two seasons' work have already been published. A very brief description of the exploration performed this spring has been communicated through a Reuter's interviewer.

In March 1897 Mr. Jackson and Lieutenant Armitage carried out a two months' sledge journey to Western Franz-Josef Land, where they encountered very bad weather and lost a pony and many dogs. Later, they travelled eastwards, but on the second day they lost their provisions, owing to the sledge falling through the thin ice, which necessitated a rapid forced march homewards.

Mr. Jackson has proved that Franz-Josef Land is an archipelago. He has explored most of it, except "some odd corners," determined its northern coast, and decided that Gillies Land does not exist, or that, if it does, it is the south-western extremity of Franz-Josef Land, which he has christened Cape Mary Harmsworth.

Besides this extension of our topographical knowledge of the archipelago, the most valuable results of the expedition will be the regular series of meteorological and magnetic observations. The meteorological data, when discussed with those of the *Fram* and of Nansen and Johannsen, as well as with those of Ekroll in Spitzbergen and Peary in Greenland, will be of exceptional value, and we trust that this part of the work will soon be completed and published. In addition to this systematic routine work, the scientific members of the expedition must have accumulated considerable collections of material—geological, botanical, zoological—which will take some time to work up.

GENERAL.

Submarine Changes.—Professor J. Milne, F.R.S., read a paper on this subject to the British Association at Toronto, of which we give his abstract. The communication was largely an epitome of a lengthy paper on "Suboceanic Changes," published in the July and August numbers of the *Geographical Journal*. To this, however, a few new but important observations were added.

Dr. Milne pointed out that the general result of denudation on the land was to bring materials to a lower level, and by gradually wearing away excrescences like mountain heights to render such forms more stable. Beneath the sea these materials are accumulated in slopes, which, being formed largely under the influence of gravity, are unstable. As the deposits grow, from time to time facial slidings take place from weight alone, and from the escape of fresh water from subterranean springs. The most important cause of submarine landslides are the shakings accompanying submarine earthquakes, these disturbances resulting in effects at least equal to, but probably greater than, those we see produced upon the land. Observations conducted over many years have shown that earthquakes,

which are announcements that adjustments in strain or isostasy of rock masses are in progress, are much more frequent along the submerged slopes of the continental plateau than they are on land, which leads to the conclusion that the districts of greatest secular movements on the surface of our planet are to be found beneath the ocean. The best evidence for these facts is furnished by submarine cables.

Besides interruptions due to waves, the borings of teredo, and other operations in shallow water, we have a class of interruptions at comparatively great depths, in some instances exceeding 2000 fathoms. In almost all these instances, which do not occur in the flat plains of ocean beds, but along the edge of submarine banks and the edges of the submerged continental frontier, the cables are apparently buried by the sliding downwards of large bodies of materials from higher levels. The result of this is that it has often happened that two or three cables, 10 or 15 miles apart, have been destroyed simultaneously. Many examples were given where an earthquake, more or less severe, has been felt on land, and at the same moment a cable has been broken. In some instances when this has occurred, an impulse has been given which has thrown an ocean like the Pacific into a state of agitation for a period of one or two days.

When these submarine disturbances have been great, the resultant earth movement has been such that, with suitable instruments, it might be recorded at any point upon the surface of the globe.

The most remarkable observations connected with submarine earthquakes are, however, those which have resulted in changes of depth up to at least 200 fathoms over considerable areas. To study these submarine dislocations, and to determine whether cables have been interrupted by artificial operations such as accompany war, or by natural means, horizontal pendulums which will record the unfelt movements of the earth's crust should be established round the shores of all our continents and on oceanic islands. The importance of these observations to our colonies must be apparent.

Another set of phenomena which promise to throw light upon the fluctuations in the enormous strains within the rocky envelope of our planet, which sometimes culminate in fractures, 100 or more miles in length, are the records of magnetometers. The effect of torsional and other strains on the magnetic conditions of iron and nickel is well known, and it may reasonably be supposed that kindred effects may be induced by strain in rock-masses. At all events, at three magnetic stations on the coast of Japan, commencing in one case a week, and in another about two weeks, before the great earthquakes of 1896 in that country, the instruments showed marked but abnormal movements, these being greatest at the station nearest to the seismic foci. They reached a maximum some hours before the shocks took place, after which unusual displacements ceased.

Should future observations confirm that which is here noted, we shall then have at our disposal another method of gaining information of changes in operations, the scene of which is hidden from our view not only by the oceans but by the solid rock.

Centres of Action of the Atmosphere.—The term "centres of atmospheric action" was first used by Mr. L. Teisserenc de Bort to signify the regions of high and low pressure which are found on most maps showing either the distribution of mean pressure or that for a given moment. Mr. Teisserenc de Bort's classical study of the abnormal winters of 1879 and 1880 (*Annales du Bureau Cent. Météor. de France*, 1881), showed that there was some relation between the position of these centres and certain climatological characteristics. He pointed out that the study

of the meteorological changes, especially those of pressure, of Madeira and the Azores, in Iceland, Greenland, in the Bermudas, and Central Siberia, might lead to the foretelling for a season of the general weather conditions in Europe.

Dr. Van Bebber of the German Naval Observatory and others have continued the work of Mr. Teisserenc de Bort. Professor H. H. Hildebrandsson of Upsala recently made a communication on this subject to the International Meteorological Conference in Paris, 1896 (*Report, Meteorological Council, Official No.* 127), and he has now published the full text, tables, and illustrative maps of his paper in the twenty-ninth volume of the *Handlingar* of the Swedish Royal Academy of Science.

Choosing 68 stations, as evenly distributed over the earth's surface as possible, Dr. Hildebrandsson calculated the mean pressures and deviations therefrom for every month of the ten years, 1875-84. The differences from the mean, when mapped, showed (1) that they were greater in winter than in summer; (2) that they increased from equator to pole; and (3) that the greatest differences occurred in January and July near Greenland and Iceland, and between the White Sea and St. Petersburg; (4) that the variations near Iceland were usually of opposite sign to those at the Azores; (5) that opposition of sign is found between pressure differences in Siberia and Alaska; and (6) between those of Tahiti and Cape Horn. The rise or fall of pressure in Azores is almost synchronous with that in Siberia, with few exceptions.

Other centres exist at Mauritius, probably over the Gulf of Mexico, and perhaps a secondary one in Baffin's Bay; while there must be others in the southern oceans. We do not possess observations from all these centres, and Professor Hildebrandsson points our how important it is that regular observations should be made without delay at all centres of atmospheric action.

As an example, Professor Hildebrandsson considers the case of the Baltic Sea, which is influenced mainly by the Iceland, the Azores, and the North Russian centres. When the Iceland centre is the most important the winter is mild like ours, whereas, when the North Russian centre influences it most, the winter is of Siberian intensity.

This work is important for all students of secular climatic variations. It indicates the regions on which attention should first be concentrated. When the weather sequences have been discovered for these determining centres of atmospheric activity, then it will be possible to investigate those of intermediate regions with some hope of classifying, explaining, and ultimately of forecasting them.

An Atlas on a Uniform Scale.—The unsystematic and confused condition of the teaching of geography in this country is evident in the success that is still enjoyed by the atlases whose scales and projections are never considered by either those who compile or those who use them. Indeed, on such atlases the scale is rarely mentioned. In recent years two or three school atlases have been published in which some regard to scale, but still too little thought about projections, is manifest.

But even atlases whose maps are drawn on "natural" scales, which are also multiples of the largest scale employed, are not sufficient. As Professor Élisée Reclus and Mr. Georges Guyou point out (in the *Bulletin de la Société neuchateloise de Géographie*, ix., pp. 159-164), it is surprising that the urgent need of an atlas of the earth's surface, with all the maps on the same scale, is not usually felt. The scale of maps showing political boundaries may not be very

important, but physical maps should be on a uniform scale to permit accurate comparisons.[1]

They therefore propose to construct an atlas on a uniform scale of 1 : 10,000,000, which would consist of thirty-eight maps. This would allow Europe to be drawn on one sheet of the atlas. The size of each map would be 430 by 610 millimètres (17 by 24 inches). There would be two polar maps, and an equatorial and four other zones, the first divided into eight maps, the others into seven and six respectively. By a slight shifting of the position of some plates, the natural geographical unities would be shown on one sheet; but to meet two exceptions special maps would be added, one with the Caspian and the other with the West Indies as centre.

In no atlas can the earth's surface be represented without some distortion. The elements to be considered are lengths in two directions (let us say radial and tangential), areas and angles. The proposed atlas would have an equivalent projection—that is to say, any and every area on the map would be a constant proportion of the area it represented. The scale, 1 : 10,000,000, is to apply exactly to the radius of 20° from the centre of each sheet. The other elements would not be quite equivalent, and the distortion would increase with distance from the centre. The mapping, however, would not be carried to the corners of the sheets in order to keep the errors within certain limits. The greatest deformation of angle, measured on the tangent, would be 5½ per cent., and the greatest error in length would not exceed 3½ per cent. The linear errors are less than those due to shrinking of paper, and to measure this inevitable change, each sheet will have a definite length marked on the margin (it would be better on two adjacent margins), which can be measured by the owner of the atlas for himself—a very important addition to a map for all those who wish to make accurate measurements.

Messrs. Reclus and Guyou do not, of course, think that an atlas should have all maps on the same scale, but only that the whole world should be represented on maps of the same scale. They propose that the atlas should consist of :—

1st. A general map.

2nd. A sheet showing the errors at different parts of each of the 38 maps.

3rd. Thirty-eight maps; scale 1 : 10,000,000.

4th. Other maps on a larger scale that may be considered necessary.

They also propose a pocket-atlas on these lines, with the 38 maps reduced by photography to a scale of 1 : 50,000,000.

With the physical features properly shown, such an atlas as that proposed by Messrs. Reclus and Guyou will be indispensable to every student of comparative physical geography, and we hope that we may soon have the advantage of seeing their proposal carried into effect.

MISCELLANEOUS.

From the *Brisbane Courier* we learn that the Hon. R. Barr-Smith, of Torrens Park, South Australia, has offered to give the sum necessary to establish a tentative meteorological station on Mount Kosciusko. We hope that this will soon be started, and that a suitable low-level station will also be found.

[1] The late Mr. Richard A. Proctor prepared an atlas of the world in twelve maps, each on the same scale, and on a uniform projection (Longmans, 1889). In it the errors were carefully noted, as they will be in the proposed 1 : 10,000,000 map. Unfortunately Mr. Proctor's maps have no contours, and are coloured to show the different states. The ocean-currents, however, are marked on them. This useful little atlas is not nearly so well known as it ought to be.

The preliminary figures of the 1895 census of Chile gives the total population as 2,712,145 for an area of 753,216 square kilomètres; but the census is not complete, and probably the population is ten per cent. greater, and may be estimated at approximately 3 millions.

The United States consul at Cartagena, Colombia, reports that a vast coal field, covering over 200,000 acres, has been discovered in the department of Bolivar, about a dozen miles from the Bay of Cispata, and less than 50 miles from Cartagena. The seams are said to be from 1 to 10 feet thick of good quality steaming coal.—*South American Journal.*

The French and Brazilian republics have referred their dispute about the boundary between their possessions in Guiana to the arbitration of the Swiss government. The French claim that the Japoc or Vincent Pinson river of the Treaty of Utrecht is the Araguary (Araouary) river which enters the ocean south of Cape do Norte, while the Brazilians maintain that it is the Oyapoc, whose mouth is west of the Cape of Orange. The French continue their boundary up the Araguary, then, parallel to the Amazon, to the Rio Branco, and up this river to its source in the Acarary mountains; whereas the Brazilians make it follow the parallel of 2° 24′ N. to the frontier of Dutch Guiana.

A new rich gold-field has been discovered in Canada. Prospectors, near Lake Wawa, in North-west Ontario, have discovered good gold-bearing quartz, samples of which, when crushed in the laboratory of the M'Gill University, Montreal, yielded as much as £48 of gold per ton of quartz. A great rush has taken place to Lake Wawa, which is near Michipicoten, and close to the main line of the Canadian Pacific Railway.

NEW BOOKS.

British Central Africa. By Sir Harry H. Johnston, K.C.B. With 6 Maps and 220 Illustrations. London: Methuen and Co., 1897. 1 vol. Pp. 544. *Price* 30*s. net.*

This is quite the most valuable work that has come from Sir Harry Johnston's pen. An artist, an explorer, and a student of botany, zoology, and anthropology, he combines many essential qualifications for giving a good descriptive and scientific account of a region in Africa which it has been his good fortune to administer as her Majesty's Commissioner. That region—roughly speaking Nyasaland—should be well known to members of the Royal Scottish Geographical Society, for it was partly due to the initiative of the Society's Council that it eventually came under the British flag, and the determining influence was given by one of the Society's explorers. In conjunction with the Church of Scotland and Free Church Missions and the African Lakes Company, the Society laboured assiduously to focus public opinion on the value of Nyasaland as a field for commercial and missionary enterprise; and, after convening several public meetings, took part in an important deputation to Lord Salisbury, the chief object of which was to secure the free navigation of the Zambezi and the declaration of a British Protectorate north of the Ruo river. Sir Harry Johnston's work was valuable in smoothing away diplomatic difficulties, as against the claims of Portugal, and in reconciling conflicting elements; but, until the Society's explorer, Mr. Daniel J. Rankin, discovered the Chindé mouth of the Zambezi, giving free access to Nyasaland, her

Majesty's Government were loath to accept the responsibility of a Protectorate. It was Scottish missionaries and Scottish traders who bore the burden and heat of the day in opening up this new sphere of British influence; and from a single coffee-plant sent out from the Edinburgh Botanical Gardens has grown up the chief industry in the Shiré Highlands, upon which success as a commercial colony must ultimately depend. For these reasons our members should take an exceptional interest in the development of British Central Africa.

Sir Harry Johnston is an entertaining and instructive writer. He tells at considerable length the story of how the Protectorate was founded, and how gradually it emerged, after many vicissitudes, into what it now is—the most successful of British possessions in Tropical Africa—successful in a legitimate way and on the true principles of tropical colonisation by white people. The administration is framed to meet the requirements of a much larger European population than at present exists—some 350 souls—and its dignity loses nothing at the hands of a writer who, for example, in speaking of his "ever-victorious army," composed of 100 Sikhs and 300 natives, with 8 English staff-officers, says:—"I was temporarily deprived of the services of my commander-in-chief, who for a few days was obliged to lie up" (p. 137), and all through the narrative speaks in much the same exalted tone; but though practically in advance of the rough and ready requirements of an infant colony, it leaves room for adaptation, and in the able hands of Mr. Alfred Sharpe, the present Commissioner, it is likely to be as effective as it is ornamental.

After history comes description of the country and its people, and of the manner of life led both by natives and Europeans, all capitally illustrated from photographs and by reproductions from the author's original sketches. The strictly scientific treatment of certain subjects (even to the introduction of Latin sentences to cheat the understanding of the vulgar) seems somewhat incongruous in a book of this calibre, and emphasises the want of balance which is its chief literary defect. A little more generalisation, which the author holds in contempt (*vide* Preface), and re-arrangement of material, would have added to its value as a popular handbook. We are, however, grateful for what we have received. The chapters on botany, zoology, and anthropology (with appendices) are in themselves valuable monographs, and the result of close personal observation and study. The subject of foreign missionary enterprise is dealt with fearlessly and in a friendly spirit; but the important question of the Slave Trade receives inadequate and imperfect treatment.

On the whole this is the record of successful work, in which the author has taken a prominent part, and bears evidence of his capacity and diligence as a scientific observer.

The maps, by Bartholomew, are excellent, that of the Shiré Highlands deserving special mention.

Life in Early Britain. By Bertram C. A. Windle. London: David Nutt, 1897. Pp. xv + 244. *Price 3s. 6d.*

Professor Windle modestly expresses the hope "that this little book may be serviceable as an introduction to the study of Prehistoric Archæology," and there can be no doubt that it will prove so. It moreover contains a great deal of valuable information relating to "early historic times," and indeed much that is truly "historic." The difficulty of distinguishing between what is "historic" and what "prehistoric" is perhaps nowhere more clearly seen than in Dr. Windle's references to Irish and Scottish lake-dwellings or "crannogs," which were inhabited as recently as the reign of James VI. of Scotland. These structures are dealt with

under the heading of "The Bronze Period," a term which, although approved of by many archæologists, is apt to perplex the unwary outsider, who, from its position in this book, would infer that it denoted an era prior to the arrival of the Romans. But structures which, as in those specified instances, were in regular occupation during the sixteenth century may have only been built two or three centuries earlier. In such cases they would be of much more recent date, although more primitive in design, than the castles of the Normans, not to say of the Romans. Consequently, when there is no distinct geological testimony to their antiquity, it is impossible to decide whether certain crannogs were prehistoric or late historic.

Dr. Windle makes some very interesting and suggestive comparisons in connection with the great megalithic monuments of these islands:—

"Perhaps we may obtain a clue as to the manner in which the stones were moved by looking at the pictures of the transport of the huge stone figures of Egypt, as represented on some of the buildings of that country. . . . But we have a further example of how the work of shaping and carrying these huge stones may have been effected, by the way in which it is carried out by the Khasis, a tribe of Northern Bengal, who break and flake their blocks by heating them along the required line of fracture and then pouring water upon them. They transport them by placing wooden rollers underneath and then harnessing numbers of men to them with ropes of rattan. When it is necessary to set a block upright, one end is slipped into a hole some feet in depth, whilst the other is pulled upon by the ropes. And finally, when it is desired to lift one block into position on the top of others, a slope of earth is constructed leading up to the desired altitude and then the impost is pulled up the slope upon rollers. Obviously it is possible that huge masses can be transported even with rude means, all that is necessary being a sufficiency of men and of enthusiasm."

Prefixed is a map of "Early Britain: showing Roman roads and places of importance mentioned in the book"; and the text is enriched with many excellent illustrations.

Les Aryans au nord et au sud de l'Hindou-Kouch. Par Charles de Ujfalvy. Paris: Masson, 1896. Pp. xv+488. Map.

The author of this work is well known as a writer of Central Asian travels, but in the present work he is anthropologist rather than traveller. He considers physical anthropology, which practically means craniology, by far the most valuable science for constructing a history of mankind. He admits that other sciences, such as ethnography, biology, archæology, geography, philology, etc., may usefully supplement it, but he speaks with impatience of "l'echafandage vermoulu des sciences politiques, basées, jusqu'à ce jour, sur des dissertations compliquées d'une métaphysique puérile et d'une philosophie spéculative." For him man is the absolute Man of his environment and circumstances, and he therefore approves the wisdom of Mohammedan fatalism, but carries this rather far.

Geographers, however, will find much of interest not only in the detailed account of the Central Asian races and tribes—especially those in the region of the Hindu Kush—but also in the speculations, founded mainly on craniological observations, not without support from ancient Chinese and other records and various standard authorities, as to the origin, relation, and dates of their migrations and settlements.

There is a very valuable geographical and historical introduction, giving a lucid physical description, based on Baron F. von Richthofen's great work, of the sharply defined region, well marked off from the rest of the continent, which we know as "Central Asia," with its transitional and peripheral zones surrounding the desiccated centre, the character of each region intimately influencing the character and history of its inhabitants.

The ethnological introduction is also interesting, and gives a *résumé* of the peoples of which the volume treats in detail.

Glimpses of Life in Bermuda and the Tropics. By MARGARET NEWTON. Illustrated. London: Digby, Long, and Co., N.D. Pp. xii + 256. *Price* 6*s.*

To any one desirous of getting an idea of tropical life and scenery, a trip round the West Indian Islands is perhaps the easiest and most enjoyable way of doing so. The Royal Mail steamers touch at most of the islands between Barbadoes and Jamaica, allowing the passengers opportunities for landing and sight-seeing at the various islands. Taking advantage of this mode of transit, the authoress visited the West Indies. Although in some cases but a short time in port, the writer always manages to give a very fair account of all she saw. Indeed the descriptions of scenery, places, and people are so good that the book would form an admirable Guide to the West Indies. With the help of some rather crude illustrations, a very good idea is obtained of some of the natural products of the islands, as well as striking bits of scenery. That the authoress fully appreciated the beauties of the tropics may be judged by her statement that she took over one hundred and fifty sketches in pencil and water-colours. It is unfortunate that the reproduction of some of these pictures has been so unsuccessful.

A Canadian Scrap-book. By LADY JEPHSON. With Original Illustrations by the Author. London: Marshall Russell and Co., Ltd., 1897. Pp. 183.

This little book consists of a series of seven charming essays and stories, relating to life in Canada, with an eighth entitled, "An American village." It is illustrated by six sepia sketches of considerable artistic merit. The author seems to have got into some trouble by criticising the Canadian accent, and by estimating too highly the loss sustained by Canadian society owing to the withdrawal of the Imperial troops. She explains in her preface that she intended no offence, but stands to her guns on these matters.

The Glaciers of North America. By I. C. RUSSELL. London and Boston, U.S.A.: Ginn and Co., 1897. Pp. x + 210. *Price* 7*s.* 6*d.*

In this work we are presented with an admirable account of the glaciers of North America. The author introduces his subject by describing, first, the leading characteristics of glaciers and the geological work they perform. Glacial abrasion is noticed; but Mr. Russell gives no account of the shattering and disruption of rocks which takes place under a glacier. Yet, from the geological point of view, such shattering is fully as important as the smoothing and striation which are so generally observed. The banks and ridges of gravel known as *eskers* in Ireland are termed *osars* by the author. The word is Swedish *ås*, singular; *åsar*, plural, and if it be used as a term in English it should be written *osar*, not *osars*. The glaciers of North America are confined to the Cordilleran ranges of the west and to Greenland, and each of these regions is passed in review. Then we have chapters devoted to the glaciers of the Sierra Nevada, the glaciers of Northern California and the Cascade mountains, the glaciers of Canada, the glaciers of Alaska, and the glaciers of Grinell Land and Greenland. Perhaps the chapters which will be of most interest to readers in this country are those that deal with the glaciers of Alaska and of Greenland. To students of glacial geology they must be of special importance, for the phenomena described throw much light on the origin of certain superficial formations in this and other countries in northern Europe. The author states, and no one will be inclined to dispute the statement, that North America

offers more favourable conditions for the study of existing glaciers than any other region. In Europe we have the well-known Alpine type well displayed, but not so magnificently developed as in Alaska. Of Piedmont glaciers we have no example, while in North America they have the grand Malaspina glacier. We have, fortunately, no vast "inland ice" comparable to the great *mer de glace* which covers Greenland—but we are not quite so destitute of ice-sheets as the author seems to think. The ice-fields of Norway are true ice-caps—sheets of ice developed on table-land, and therefore comparable in all respects save size to the "inland ice" of the Arctic regions. The last chapters in the book discuss the climatic changes indicated by the glaciers of North America, and the never-ending question of glacial motion.

Das Nördliche Mittel-Amerika nebst einem Ausflug nach dem Hochland von Anahuac. Reisen und Studien aus den Jahren 1888-1895 von Dr. Carl Sapper. Mit einem Bildniss der Verfassers, 17 Abbildungen, sowie acht Karten. Braunschweig: Vieweg und Sohn, 1897. Pp. x+436.

Dr. Sapper's work is a most welcome addition to the literature on a part of the American continent regarding which accurate information is by no means as accessible as one would wish. The book shows that its author has taken every advantage of the exceptional opportunities he had of studying the Northern States of Central America. He has, as he tells us, generally made his journeys on foot, and, being a good observer, has thus been able to give us a detailed account of the countries visited. In the first part of the book we accompany the author on his wanderings across Central America, and get a good general idea of its physical features and its inhabitants. Travelling in those parts seems to be quite safe nowadays, except, perhaps, in the independent native states, which, it must not be forgotten, still exist within the political boundaries of Mexico. The second part deals with a variety of subjects connected with Central America, and will be of great interest to the geographer, the ethnologist, and the business man. It is disappointing to learn that there are more mines in the country than the supply of minerals requires, and also that the forest trees of commercial value are fast disappearing from the spots where they can be profitably got at. Fertile as the country undoubtedly is, our author states that two crops of maize in a year are exceptional, and three or four, as some accounts will have it, purely a myth. There is still, however, a good chance for the European settler. The natives are docile and skilful, although not particularly fond of agricultural labour. But any real progress would depend rather on more rational methods of exploitation than on a more plentiful supply of native labourers. Our author has given much attention to ethnological questions, the language, music of the natives, etc., and has collected airs and specimens of the languages. His chapters on the architectural remains and his attempt to distinguish different styles are very interesting. In the last essay he deals with the original home of the Mayas, and comes to the conclusion that they came from the mountainous regions of Chiapas in Guatemala and settled long ago in the lowlands of Yucatan.

We would like to call special attention to the excellent maps illustrative of the climate, vegetation, and ethnology of Northern Central America.

Ansichten aus Südamerica. Schilderung einer Reise am La Plata in den argentinischen Anden und an der Westküste, von Jean Habel. Mit 70 Tafeln, etc. Berlin: Dietrict Reimer, 1897. Pp. xii+76.

Herr Habel spent several months in 1893-94 near the Uspallata passes, leading from the Argentine Republic into Chile, and was so much struck with the features

of the country that he returned the following year in order to scientifically explore it. He had, however, hardly set to work when he was arrested by the Argentine Government as a spy, and had to leave the country. This is much to be regretted; for, from the author's notes, and still more from the numerous plates reproducing the scenery of the few valleys which he was allowed to study, it is clear that those parts of the Andes would well repay a thorough exploration. The chief interest of the book lies in the plates, which are excellently reproduced from photographs taken by the author, and which enable the reader to appreciate the charms of the high valleys south of Aconcagua, which are so different from Alpine valleys. The author has added a short sketch of his journey from Europe to the Andes and back, with illustrations of some of the places visited. The short notes on his outfit may be of use to intending explorers.

Natural Elementary Geography. By JACQUES W. REDWAY. New York, Cincinnati, Chicago: American Book Company.

This is a very good specimen of an American text-book for junior pupils. That it is "American" is evident, not only from the title-page, but also from the spelling, the vocabulary, and the fact that about one-third of the book is devoted to the U.S.A. It is, therefore, not likely to be used except in those States. But as written from its particular point of view it is a good book. The subject-matter is well chosen, brightly and clearly expressed, and mainly free from error. The pupil is constantly called on to be active and not passive; to be searching his maps for facts, and using his brain for reasons, and not merely receiving information. The pictorial illustrations are many and good. The maps are generally adequate, though the physical maps lack latitudes and longitudes, and the political ones would be improved by the insertion of the chief railways. It is a good feature that the scales of the maps are definitely inter-related. In so good a book it is disappointing to find so much confusion in the use of the terms England, Great Britain, Britain, English, British. The boundary between Europe and Asia is not correctly given. The physical map of Africa contains some strange errors in the region of the great lakes—errors that do not appear in the political map. The term "branch" is not a good substitute for "tributary" (p. 27); and "valley" and "basin" are not synonyms (p. 28).

Leitfaden der Geographie für höhere Lehranstalten, im Anschluss an die preussischen Unterrichtspläne von 1892 *und unter Zugrundelegung der Debesschen Schulatlanten.* Von Prof. Dr. R. LANGENBECK. Erster Teil. Lehrstoff der unteren Klassen. Mit 7 Figuren im Text. 2e Umgearbeitete Auflage. Leipzig: Engelmann, 1897. Pp. viii + 137. *Price, M.* 0.80.

The title describes the purpose of this little book, which is divided into three parts. The first part, the subject-matter for the sixth or lowest class, comprises the elements of mathematical and physical geography, an introduction to the understanding of globes and maps, and a synopsis of the geography of the continents. The second part deals especially with Central Europe, and discusses its physical geography as a whole, then the German Empire, and lastly the other states of Central Europe. The third part, which is to be taught to the fourth class, treats of mathematical geography, globes, and maps somewhat more fully, and then takes up the geography of all the countries of Europe except those of Central Europe, physical preceding political descriptions.

The book is written in a clear, simple style, and definitions of terms are skilfully introduced as occasion for their use arises. There are, perhaps, too many

facts mentioned in the book, which is remarkable for an absence of pictures. But we must remember that German schoolmasters do not use such books, either as reading or lesson books, quite in the way with which we are familiar in this country.

Four pages are given to the British Isles. We read: "The fertile soil of the English plain is mainly in the possession of great proprietors, who employ a considerable part of it for park and garden grounds. Agriculture is therefore carried on extensively only in Ireland." (!) The area given as that of the British Empire is, at least, ten per cent. too small, and the population diminished by about sixty millions! Bristol, along with Liverpool, is quoted as the most important trade centre after London. Cardiff is not mentioned, nor Leeds. Newfoundland is not given among the chief American colonies, but Honduras is, while the Cape is the only British colony mentioned south of Tanganyika. Nimes is wrongly spelt with a circumflex.

Cassell's Gazetteer of Great Britain and Ireland. Being a Complete Dictionary of the United Kingdom. With numerous Illustrations and Sixty Maps. Vol. III. Fromebridge—Kiltearn. Vol. IV. Kilteel—Newchapel. London: Cassell and Company, Limited, 1896. *Price 7s. 6d. per volume.*

We have already noticed two volumes of this excellent Gazetteer, which continues as it began to give careful summaries of information about different places. There is no sign of the physical, railway, and other maps which ought to accompany "a complete dictionary of the United Kingdom." The political maps are a little rough in execution. Numerous little photographic illustrations of places are a welcome innovation in this Gazetteer.

Les Transports par Terre et par Mer. Documents pour servir à l'Histoire Economique de la Troisième République. Thèmes des Conférences. Par PAUL VIBERT (THÉODORE VIBERT, fils). Paris et Nancy: Berger, Levrault et Cie., 1896. Pp. 1 + 470. *Price* 10 *Fr.*

In his preface the author tells us that this book is no didactic treatise, no historical account of the development of means of transport, and still less a body of doctrine, but is meant to be a living and faithful picture of the means of transport at the end of the century. It is a light, readable, redundant account of French railways, especially of what and where they are not and might be. In the section on "geography and railways" the author points out the great advantage of the practice of some lines which put good maps of their network in every carriage. He notes the admirable custom of that railway of plainly showing forth not only the name of each station but also that of the département in which it is, its height above the sea-level, and its distance not merely from Paris but from surrounding towns; a custom which might well be copied by our railway companies, who too often permit even the names of their stations to be annihilated by advertisements.

Illustrative Cloud Forms for the Guidance of Observers in the Classification of Clouds. 16 Coloured Plates, with Notes. Washington: Hydrographic Office, 1897.

Captain Sigsbee, the U.S. hydrographer, has had the admirable idea of compiling a convenient little pocket atlas of cloud forms, using the international nomenclature, and basing the plates on the international cloud atlas, many photographs, and the personal observations not only of himself and the artist, Mr. Cronan, but also of such experts as Mr. A. Lawrence Rotch and Mr. H. H. Clayton of Blue Hill Observatory. The result is eminently satisfactory, and we can heartily

commend the work. Naturally the sea appears in all these coloured pictures, and we are glad to observe that attention has been paid to the appearance of the waters with the different cloud forms. This is a matter too often neglected by observers near the sea, but one to which attention should constantly be paid by those who wish to forecast the weather.

Bilder-Atlas zur Geographie von Europa. Mit beschreibendem Text. Von Dr. Alois Geistbeck. Leipzig und Wien: Bibliographisches Institut, 1897. Pp. i+148. *Price M.* 2.25.

The Bibliographisches Institut has a wonderful knack of utilising its pictures and maps in many ways. The present collection of 128 pages of pictures is mainly composed of those in the volume on Europe by Professors Philippson and Neumann in *Sievers Allgemeine Landeskunde*, and as they are on the whole well chosen, they may be useful to many who do not possess the larger book. Dr. Geistbeck has written about fifty pages of light comment in a very readable form. The view of Edinburgh from the Calton Hill, drawn from a photograph, has not been well done, but the majority of the pictures give a good general idea of what they represent.

Pictorial England and Wales. With upwards of 320 Copyright Illustrations. London: Cassell and Co., Limited. Pp. xvi+320. *Price* 9*s.*

Another of the picture-books reproducing photographs of places and scenes has been added to those with which the market has recently been inundated. The excellent illustrations in this are admirably reproduced; but the arrangement of pictures is not a whit more intelligent than that in other productions of the same kind, and leads one to suspect that the youngest apprentice is usually intrusted with the arranging of them. Is there no publisher left in the country who could see that such fine material for producing beautiful and educative books is not wholly misused?

North Berwick and its Vicinity. With descriptive and historical notices of the Bass Rock, Tantallon Castle, and other interesting objects and localities, and with rules of the game of Golf as played at North Berwick. Revised edition. Edinburgh: Oliphant, Anderson, and Ferrier, n.d. Pp. i+126. *Price* 1*s.*

This handy guide-book is now in its thirteenth edition, and has evidently been of value to the many patrons of North Berwick, who can find in it much that they want to know about the history of the region, the plants, animals, golf, or sea-bathing. The book is illustrated by some good photographs and an uncoloured print from Bartholomew's two-miles-to-the-inch map of the district.

We have to acknowledge the receipt of the *22nd and 23rd Annual Reports of the Geological and Natural History Survey of Minnesota*, edited by the State Geologist, Professor N. H. Winchell, which contain many papers of value to those interested in that State.

From the Great Eastern Railway Company we have received the following parcel of books, which will doubtless prove useful to members thinking of holiday-ing in East Anglia:—

The Official Guide to the Great Eastern Railway, and the Harwich Route to the Continent. Illustrated. London: Cassell and Co., Ltd., 1897. Pp. 352.

Summer in Broadland: Gipsying in East Anglian Waters. By H. M. Doughty. Sixth Edition. London: Jarrold and Sons, 1897. Pp. 136.

Rambles in East Anglia: or, Holiday Excursions among the Rivers and Broads. By HARRY BRITTAIN. London: Jarrold and Sons, N.D. Pp. 150.

Poppy-Land: Papers descriptive of Scenery on the East Coast. By CLEMENT SCOTT. Illustrated by F. H. TOWNSEND. Seventh edition. London: Jarrold and Son, 1897. Pp. 134.

How to organise a Cruise on the Broads. By E. R. SUFFLING. Third edition. London: Jarrold and Sons, 1897. Pp. 140.

Photo Pictures in East Anglia. By PAYNE JENNINGS, with Descriptive Letterpress by ANNIE BERLYN. Ashstead, Surrey, N.D.

NEW MAPS

ATLASES.

ATLAS FÜR MITTEL- UND OBERKLASSEN HÖHERER LEHRANSTALTEN. Herausgegeben von Dr. R. Lehmann und Dr. W. Petzold. 69 Haupt- und 88 Nebenkarten auf 80 Kartenseiten, 1897. *Prices, bound M.* 5.50, *sewn M.* 4.60. *Ausgeführt in der Geographischen Anstalt von Velhagen und Klasing in Leipzig.*

To bring out a new school atlas in Germany at the present time, when there are already so many excellent ones, implies no little skill and enterprise. But there is encouragement in the fact that in Germany there is always a keen critical appreciation of good cartography, and no matter how many atlases there may be in the field, if a better one be produced it is sure to be welcomed. The present atlas, just issued from the Geographical Institute of Messrs. Velhagen and Klasing, under the editorship of Dr. Lehmann and Dr. Petzold, has much to recommend it. It contains no new features of any consequence, but may be fairly described as representing a combination of the best features of the existing school atlases, beautifully reproduced and issued at a much cheaper price. Profiting by the many recent advances displayed by its forerunners it shows a greater completeness of systematic treatment, especially in the mapping of the various aspects of physical geography. This, combined with technical beauty of execution, places the atlas in the front rank of educational works.

ATLAS FÜR HANDELSSCHULEN. Gezeichnet und redigiert von Dr. K. Peucker. Fachmännisch bearbeitet von Dr. Th. Cicalek, Dr. J. G. Rothaug, Dr. K. Zehden. 36 Hauptkarten, 64 Nebenkarten, Diagrammen, Stadt- und Hafenplänen, 1896. *Price, bound Fl.* 3.75. *Artaria and Co., Wien.*

The conception of this school atlas is excellent, and although the technical execution in engraving and printing cannot be said to be of the highest class, yet it possesses an originality of treatment which ought to excuse some crudity in a first edition.

The orographical maps are simple and effective, while on the political maps a fairly successful attempt has been made to show the orographical basis in contours with grey shading under the political colouring. When this is achieved without confusion it forms a feature of great value. Except for one overcrowded world-map of vegetable products, and a number of diagrams showing comparative products of different countries, there is little to justify its claim to be an atlas specially

adapted for Handelsschulen. A supplementary collection of plans of cities on various scales and in various styles is interesting, but would have been more instructive had there been more uniformity of scale and treatment. As an atlas for Austro-Hungarian schools it is well adapted, nine out of thirty-six maps being devoted to the united monarchy.

WORLD.

DR. HERMANN BERGHAUS' CHART OF THE WORLD. Completely revised by H. Habenicht and B. Domann. 12th Edition, 4 sheets.

Justus Perthes, Gotha, 1897.

The first edition of this well-known chart of the world was published in 1863 by H. Berghaus and F. von Stülpnagel. It was the first of its kind and was well received by all nationalities. In its favour was the fact of its being written in English, the commercial language of the world. In 1867 it was found necessary to issue an almost new work, and since then it has been brought up to date at short intervals. The present entirely new edition is the twelfth, and has been compiled by H. Habenicht and B. Domann, the former being responsible for the sea and the latter for the land. All former editions of the chart showed the steamer-routes by various lines, each nationality being represented by a different colour. The new edition shows great improvement in this respect, because it gives the best and nearest routes taken by steamers as well as sailing vessels, the latter being distinguished according to the seasons of the year, while the direction, outward or homeward bound, is indicated by an arrow. A list of the principal steamship lines is printed in the margin and arranged according to continents and nationalities, and at the same time a full explanation of the numbers and letters employed on the chart is given. Cold and warm currents with their velocities are distinguished ; limits of winds and calms are shown and refer either to January or July ; and on an inset spring and autumn limits are marked. The limits of pack ice, the average and extreme limits of drift ice, sea weeds, and the variation of the magnetic needle as well as the 200 mètre line are given. Railways, caravan-routes, docks, and coaling stations, with the exception of those of Northern and Western Europe, are laid down. On an inset the cables and co-tidal lines are shown. Treaty ports open to foreign commerce in China, Japan, and Korea are marked. The world on Larbert's polar projection, showing steam-navigation and railways round the world, in the northern and southern hemisphere, is given as an inset. In Canada an attempt has been made to lay down the boundaries of the new districts of the North-West Territories, but they do not agree with those shown on the map of Canada, published with the *British Association Handbook for Canada*. The eastern frontier of the Yukon district runs on the mountains nearer to the Mackenzie river till it meets the Liard on the northern boundary of British Columbia. The portion added on the chart to Athabasca between the 100th and 110th long. west of Greenwich has been given to Mackenzie district. Northern territory has been incorporated with Keewatin. The northern boundary of Quebec has been extended northwards to East Main and Hamilton rivers. The western boundary of the Labrador dependency of Newfoundland is still undefined and does not run along the watershed as shown on the chart, but parallel with the coast. The new important steamship-lines from Glasgow and Liverpool to St. John, New Brunswick (not St. Johns as written on the chart) are not shown at all. These slight deficiencies can easily be rectified in a future edition. The chart as a whole is admirably executed, and does great credit to the authors as well as the publisher.

EUROPE.

BRITISH ISLES.

EDINBURGH. A Parliamentary and Municipal Plan of Edinburgh, Leith, and Suburbs. By J. Bartholomew. *Price 4s. on cloth.*
J. Bartholomew and Co., Edinburgh.

PENTLAND HILLS. The Pedestrian's Map of the Pentland Hills, with Itinerary showing Public Paths. By J. Bartholomew. Scale one and a half inches to one mile. *Price 2s. on cloth.* *J. Bartholomew and Co., Edinburgh.*

SCOTLAND. New "Three miles to inch" map of Scotland, coloured for Tourists, Cyclists, and General Reference. Sheets 1, 2, 3, 10, and 11. *Price, on cloth, 1s. 6d. each.* *W. and A. K. Johnston, Edinburgh.*

ENGLAND AND WALES. New Cyclist's Map of England and Wales in twelve sheets. Scale four miles to one inch. *Price of each sheet, 2s. on cloth.*
J. Bartholomew and Co., Edinburgh.

NEW FOREST AND ISLE OF WIGHT. New Map of New Forest and Isle of Wight. Scale two miles to one inch, with contour colouring. *Price 2s. on cloth.*
J. Bartholomew and Co., Edinburgh.

ASIA.

INDIA, Northern Frontier of ——. Sketch Map of Routes traversed by European and Asiatic Explorers beyond the British Frontier from 1865-1897.
Registry and Record Department, India Office.

This map has been compiled to accompany *A Memoir on the Indian Survey*, 1885-1890, by C. E. Black, published in 1891, and the routes of explorers in Tibet, the Pamirs, Afghanistan, and British Baluchistan are laid down. The itineraries are printed in green and the hills in brown. The map is well drawn, and shows at a glance what has been accomplished during the last thirty-two years in the rugged mountain-regions bordering the Indian Empire in the north and north-west.

AFRICA.

CONGO FREE STATE. Carte de la Région des Lacs. Dressée par A. J. Wauters, Directeur du *Mouvement Géographique*, à l'échelle du 2,000,000.
Le Mouvement Géographique, 4th July 1897.

This seventh sheet of Mr. Wauters' map of the Congo Free State contains some interesting new features, a few of them based on materials from the note-books of the late Commander Cameron, which, curiously enough, appear never to have been utilised before.

AMERICA.

CANADA. Geological and Topographical Map of the Northern Part of the Lake of the Woods and adjacent country. Edition of April 1897. Scale two miles to one inch. *Geological Survey of Canada.*

VENEZUELA—BRITISH GUIANA. Maps of the Orinoco-Essequibo Region, South America, compiled for the Commission appointed by the President of the United States to investigate and report upon the true divisional line between the Republics of Venezuela and British Guiana.
Washington, February 1897.

This will be reviewed in an article on the Report of the Commissioners.

REFERENCE TO CONTOURS OF ALTITUDE
above 4000 feet
3000 to 4000 "
2000 to 3000 "
1000 to 2000 "
under 1000 feet
22
24
26
14
16
18
20
BRITISH
MARUTSE
MAMBUNDA
Songue
Kanya
Shalembe
Batunda
Lobazezo
Libunta
Lialui
Sefule
Nalolo
Lomba
Dima
Muangana
Litofe
Nameta
Sioma
Gonye Falls
Kab Rapids
Bumbu Rapids
Lusu Rapids
Nyambwe Cataracts
Katongo
Katuna Mollo Rapids
Sesheke
Kazungula
Victoria Falls
Mpalevalu
Lusuma
Mutabanja
Barakoe
Nai ini
Mungomba
Ndara
Lynanti Swamp
Chobe
Churo
Mt Ngwa
Sekumbwa
Nona Falls
Kandum
Garidum
Tso
Nano
Toubi
BANGAI
BAYEYE
Mababe Swamp
Mayane
Lingalo
Nyukanin
Moremi's Wharf
Sumaou
Kana Kama
Gnaka
MADENASSAN
BANANZA
Geshuma Flat
Daka
Nagatatollo
Boana
Kamu
Kayugu
Edzumbe
Nzala
Narzela
Sibupas
Mayunbas
Serampunta
Nyambwe
Kashi
Motondo
Kapuri Lag.
Zuti
Luanza
Luanza Mukwa
Luangue
Nyambwe Mukwa
Nyambwe Mukwa
Nyambwe
Nyambwe
Nyambwe

OROGRAPHICAL MAP OF SOUTHERN RHODESIA

Illustrating Mr Selous' Paper.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

QUEENSLAND.

By J. P. Thomson, Hon. F.R.S.G.S.,

President, Royal Geographical Society of Australasia, Brisbane Branch, etc.

(*With a Map.*)

Prior to 1859 Queensland constituted the northern portion of the mother-colony of New South Wales. During several preceding years the settlers of the Moreton district were greatly dissatisfied at what was then considered indifference to their interests on the part of the Government in Sydney. This dissatisfaction culminated in persistent and vigorous agitation in favour of separation. In due course it was granted, and the first governor, Sir G. F. Bowen, sworn in at Brisbane on December 10, 1859. From this date commenced the career of the youngest, and what was no doubt destined to be one of the most important, of the five independent colonies into which Australia is at present divided.

To students of the history of early exploration and discovery there are several well-known landmarks of especial interest on the Queensland coast. It was in the great Carpentarian Gulf that the historic Dutch navigators first became acquainted with the broken outlines of what appeared to be the northern portion of the great Southern Continent of ancient geographers. The west coast of Cape York Peninsula was, however, at first mistaken for the corresponding one of New Guinea. Along the coastline of this Peninsula are several of the very first-named landmarks of the continent. The names of Duyfhen Point, the Coen River, and Sweer's Island bear silent testimony to the early Dutch maritime enterprise in Torres Strait. In like manner the Endeavour river, on the east coast, will always be associated with the immortal name of our own Captain Cook.

It was the shore of Moreton Bay that witnessed the first struggles of the pioneer settlers in their praiseworthy efforts to conduct the march

of British Empire in Queensland. The history of the Moreton district cannot boast of antiquity: it is, indeed, but short and very recent. Within the brief period of less than half a century there have doubtless occurred many remarkable events there, of especial interest to those who have been, and are even now, associated with the development of the colony. Happily the life of the convict settlement was of comparatively short duration, and the incidents connected with it are better forgotten. They cannot have exhibited many elevating examples of social or moral conditions, worthy of record in the history of the country. Indeed, they seem to have presented some of the worst features of demoralised human nature, and their effect upon the mind of the native race could not have been otherwise than humiliating to civilisation.

Physical Features.

Queensland occupies the north-east quarter of Australia. On the extreme south it is bounded by New South Wales, from which it is separated by Macpherson's Range, the Barwan and Dumaresq rivers, and the 29th parallel; on the west by South Australia, along the 138th meridian, from its point of intersection with the 26th parallel; on the north by Torres Strait, that separates it from New Guinea; and on the east by the South Pacific Ocean. The area of the colony, including the islands, is 668,497 square miles, and the coast-line about 2500 miles in length.

Its physical structure is simple enough, and there are few striking topographical features, such as occur in the south-east corner of the continent. By this it must not be inferred that Queensland is destitute of mountain scenery, but on the whole its elevated features are less broken and distorted than in countries where bold ranges and deep valleys form conspicuous landscapes. The highlands occur chiefly in the neighbourhood of the coast. Under the somewhat general designation of the Great Dividing Range, they extend, in a more or less continuous chain, from the extreme south-east corner of the colony, at Point Danger, northwards, and almost parallel to the coast, through its entire length to Cape York. This great coastal range forms the anticlinal axis of the entire mountain system, from which radiate numerous lateral elevations, that form the watersheds between the rivers flowing westwards into the interior of the continent, and those that empty into the Gulf of Carpentaria. In some places the eastern side of the range approaches to within a short distance of the coastline, and some of its radiating spurs even encroach upon it. In the southern portion of the colony there are transverse ranges extending westerly and south-westerly from the Great Dividing Chain, and these form the watersheds of the numerous streams that flow into the Darling river. The rivers which fall into the head of the Gulf of Carpentaria are separated from the Georgina and Hamilton and the Diamantina streams, that flow south-westwards into the interior of the continent, by Barklay's Tableland and Selwyn and Kirby's ranges. Gregory Range, a lateral extension of the Great Dividing Range, running north-westwards, divides the waters of the Gilbert and Flinders rivers, both of which flow into the Gulf.

HARVEST FIELD. THE DIVIDING RANGE IN THE DISTANCE

Drummond Range lies between the waters of the Belyando river and those drained by the Nogoa and Isaac streams. The waters of the Burnett and Auburn rivers are separated from those drained by the Dawson river by Dawes' Range and its collateral offshoots, while between the Dawson river and the Comet intervene the Carnarvon and Expedition ranges.

Macpherson's Range is a rugged and picturesque forest-clad chain of mountains, culminating in Mount Lindsay, 4064 feet above sea-level. All along this great frontier chain, whose crest is studded with lofty and precipitous peaks, the scenery is magnificently grand and the climate delightful throughout the year. The soils are fertile and the vegetation luxuriant. The elevations of the coast, or Great Dividing Range, that extends northwards, vary from 2000 to 4000 feet or thereabouts above the sea. The highest points of its crest occur in the Cook district, where Mounts Bellenden-Ker and Bartle Frere attain altitudes of over 5400 feet. The topmost peaks of this great chain of mountain ranges represent the earliest insulated rudiments of what is now the Australian continent. It was some time during the Palæozoic period—an era that gave birth to widely distributed land masses in many regions of the globe—that several predominating areas of elevation were projected above the surface of the vast ocean on the east coast of this country. These now form the principal topographical features that control the drainage areas of many coastal and inland streams, whilst they also exercise a material influence in modifying the heat of the summer season.

The river systems, as established and regulated by the broad physical configuration here indicated, may, upon geographical principles, be conveniently classified into four clearly defined categories. First, there are the rivers that drain the eastern slopes of the Main Range, and flow into the Pacific Ocean. These are mostly comparatively short and rapid streams, that sometimes overflow their banks during abnormal rainfalls, and inundate large areas of low-lying country. Local physical conditions render almost the whole of their drainage areas effective, and consequently they carry an enormous quantity of water when flooded. It has, in point of fact, been estimated that during the phenomenal flood of 1893 the volume of water discharged by the Brisbane river was equal to the ordinary discharge of the Indus at Sukkur, and "very nearly equal to the maximum flood-season discharge of the Nile at Cairo." The principal rivers here are the Fitzroy, the Burdekin, and the Brisbane. The second system of rivers flows into the Gulf of Carpentaria, the third south-westerly into the interior of the continent, and the fourth into the basin of the Darling, in the southern portion of the colony.

The whole of the country, however, is naturally divided into but three great primary regions, each possessing distinctive physical and climatic characteristics. The eastern division comprises the whole of the immense tract of country flanked on the east by the coastline, and on the west by the Great Dividing Range. It is abundantly watered by the copious rainfall that is everywhere distributed over its surface throughout the year, and by the numerous rivers and small streams that traverse it. The climate of this district varies from a mild tropical type to one of

the most invigorating and health-giving temperate zones of the globe. The remarkably fertile soils are of the richest and most varied description. They comprise the immense alluvial deposits of river basins, the volcanic ejectamenta of tablelands, and the loams of the slopes. The forests are rich in valuable timbers and everywhere teem with animal and bird life; whilst, within the tropical belt, prolific nature has clothed the surface with vegetation of unsurpassed luxuriance. Here the various scrubs are remarkable for the charm of beauty and often are dense enough to exclude the rays of the sun. The mountain and woodland scenery is very beautiful, and the adjacent island landscape delightful, the climax of grandeur being attained in the mighty waterfall of the Barron river, that may justly rank amongst the first of the kind on the globe. In flood-time it is said that the wild sublimity of the scenery here is awe-inspiring—the rush and noise of the turbulent and sweeping flood-waters being indescribable, as they madly leap over the edge of the shelving precipitous rocks some 600 feet high.

The second geographic division comprises the whole of the watershed of the Gulf of Carpentaria. It lies wholly within the tropical belt, and is made up chiefly of extensive plains and undulating lands. The country is especially adapted for pastoral rather than agricultural purposes. There are, however, several scattered areas of remarkably rich, deep, loamy soil, mostly in the basins of the Batavia and the Embley rivers, on the eastern side of the gulf, that could be cultivated. There are fine forest timbers here, and the whole district is abundantly watered. The rainfall is copious, and many rivers traverse the country, chief amongst them being the Flinders, the Mitchell, the Gregory, the Leichhardt, the Norman, and Batavia. Several of these are navigable, although the extensive mud-flats along the shores of the Gulf greatly interfere with the free movements of large vessels. As a first-class pastoral country, the district possesses many natural advantages that are entirely wanting elsewhere. There is, first of all, abundance of water, and the grasses are luxuriant and nutritious. At the mouths of the Batavia and Embley rivers there are commodious harbours, where stock could be shipped, and every facility exists for the establishment of industries and the further development of the resources of the country. The drawback hitherto has been the distance from the capital of the colony, but, as railway extension is now being rapidly carried on everywhere throughout the country, the disabilities with which the district has formerly had to contend will not much longer impede its progress.

The third great division is the largest of all, and, in point of importance, only second to the first one. Indeed, it may be considered that this magnificent western district, comprising as it does the whole of the immense country west of the coast range, is in some respects superior to the others. It embraces the famous Downs country, which for richness of soil and magnificence of climate is probably unsurpassed in any other part of the world. Extending far away to the west, into South Australia, these fertile plains and rolling downs cover enormously extensive Cretaceous beds, holding artesian water at varying depths. The irregular, uncertain, and always scanty rainfall of the far western

THE BARRON FALLS

district was formerly a great drawback to pastoral enterprise. During seasons of prolonged drought, run-holders suffered greatly by loss of stock, for over the vast surface of the rich soil no grass could be obtained, and other forms of vegetation were parched and withered. Now, there is happily a complete transformation of the face of the country. Stern and relentless nature has been subdued by the art of man, and vegetation now flourishes luxuriantly on the surface of soil abundantly watered from artesian sources, whilst thirsty stock no longer wander madly and helplessly about over parched plains in quest of much-needed water. The main trunk-lines of railway extend far away towards the western frontier, and the country is becoming settled in places where formerly not a single habitation was to be seen. In many parts the land is covered with several varieties of dense low forests of acacia, *A. homalophylla*, *A. harpophylla*, and other varieties of 'scrubs,' as they are locally called. Where these occur they impart to the landscape a most agreeable and picturesque aspect, whilst the umbrageous protection they afford from the solar rays renders their presence everywhere welcome. The soils are generally black, sandy, and brown loam, varying in depth from a few inches to 10 feet or more. They are eminently adapted for fruit-growing and agriculture, as well as for grazing purposes.

Geology.

It is chiefly to my colleague and esteemed predecessor in the presidential chair of the Royal Geographical Society of Australasia in Brisbane, and to the present Government Geologist, Mr. R. L. Jack, and his staff of assistants, that we are indebted for a very full and clear elucidation of the geology of Queensland. Most of the known mineral areas have been examined, the water-bearing beds of the extensive Lower Cretaceous formation of the great western region traced out, and other important tracts of the vast territory investigated, so far as to enable us to read with tolerable accuracy its geological history.

Australia, as a whole, is probably one of the oldest land masses on the face of the globe. Even in the far back and vastly remote ages of antiquity, when numerous isolated nuclei of future land areas were formed, the evolution of Australia was greatly in advance of that of many other continents. There seems no reason whatever to doubt that most of the continent belongs to an age anterior to that of the greater part of Siberia, Europe, Asia, and Africa, and of the west coast of America. The extensive areas occupied by plutonic and metamorphic rocks along the eastern seaboard of the continent, and the occurrence of the oldest fossiliferous deposits overlying these rocks, furnish weighty evidence of a far-back history. During one of the land-making epochs, probably the Mesozoic, or even in later times, Queensland and New Guinea were united by a land extension across the shallow strait by which they are now separated. There are, indeed, several well-known writers, whose opinions are entitled to consideration, who maintain that Australia as it is now is but a portion of what was formerly a vast land mass, that stretched far away to the south and east, and was probably united

with South America and the Antarctic continent. This conjecture is chiefly based upon evidence afforded by the discovery of the remains of extinct animals and birds that were formerly distributed over these now widely separated countries. There is no reason whatever why such a land connection should not have existed, but to my mind the evidence in its favour is very far from being satisfactory, or even fairly convincing. It is, indeed, very probable, as I have before now had occasion to remark, when dealing with the subject in a former paper,[1] that Australia, New Zealand, and several of the South Pacific groups of islands, were at one time united by what my friend, Mr. Charles Hedley, of the Australian Museum, has designated the "Melanesian Plateau."[2] The theory receives support from the evidence afforded by the close affinity existing between clearly defined types of the flora and fauna of these now widely separated regions, as well as from the parallelism of their rock structure. Bones of the New Zealand moa and of the kiwi (*Metaptery.r bifrons*) have been discovered in the Post-Pliocene drifts of Queensland, whilst the existence of sedimentary and plutonic rocks, the occurrence of strata of Mesozoic age, besides extensive beds yielding fossils with a decided Tertiary facies, in both countries, furnish very strong evidence of their former union. The geological structure of the eastern district of Queensland, representing broadly about a third of the colony, consists chiefly of a series of ancient stratified rocks of Palæozoic age, the older members of which are more or less metamorphosed. There also occur granite and syenite rocks of plutonic and of metamorphic origin, as well as bedded and intrusive basic igneous ones, of various ages. The fossiliferous formations that occur amongst these ancient rocks are Palæozoic, Mesozoic, Tertiary, Post-Tertiary, and Recent. They are associated with beds designated locally the Burdekin, the Gympie, Star, and Lower, Middle, and Upper Bowen, the Burrum and Ipswich, the Rolling Downs and Desert Sandstone, and the Lower and Upper Volcanic series, with associated drifts.

This district represents what was probably an ancient tableland, the eastern base of which very likely corresponded with the present position of the outer edge of the Great Barrier Reef. The materials of of which it is composed are of the hardest possible description, and thus it is that whilst the natural process of denudation has continued to operate upon the exposed surface for ages, there still remain the dominant areas of elevation that culminate in the Great Dividing Range, the coast range, and the lofty crowns of the Bartle Frere and the Bellenden-Ker mountains. This denuding process, and the erosive action of the waters operating upon the softer structures of the tableland, have diminished it considerably in area. It no longer possesses the distinctive and essential features of a tableland region. It is now mostly cut up into detached hills and mountain masses, with intervening valleys and alluvial plains, traversed by many streams, and abundantly watered by a copious

[1] "The Melanesian Plateau," *Proc. and Trans. R.G.S.A., Brisbane*, vol. viii. p. 18.

[2] "The Range of *Placostylus*," by C. Hedley, *Proc. Linnean Soc. N.S.W.*, vol. vii. (second series), p. 335.

STARTING FOR HARVEST

rainfall. The numerous islands all along the coast-line represent masses that have been detached from the mainland by these powerful agencies, which have thus shaped the district, whilst the immense belt now occupied by the Great Barrier Reef and lateral formations furnishes evidence of its extensively diminished area. Mr. R. L. Jack and others have obtained evidence which clearly shows that the whole eastern coast of Queensland is rising, and probably this upward movement extends along the seaboard of the continent southwards. The mineral areas of the colony are mostly located within the district under consideration, and its natural resources have in consequence been developed to a far greater extent than elsewhere. Within the limited scope of a paper of this kind, it is not possible to give a detailed and full description of the geological structure of the colony, and it is equally impossible to discuss the organic remains and other fossiliferous deposits that have been examined. The fossil remains of animal and vegetable life occur over a remarkably wide range of territory, and they indicate that the country has sustained a very rich fauna and flora for untold ages.

The physical and geological structure of the western portion of Queensland is of an entirely different type from that observed in the east. Here there is a gentle and almost imperceptible surface-slope from the Main Range westwards to the great central depression of the continent, the Carpentarian Gulf, and the basin of the Darling, in New South Wales. The rivers are mostly shallow, with broad and ill-defined channels, often dry in parts during times of drought. The scrubs and other types of stunted timber-trees, of which I have already spoken, take the place of the magnificent forests and luxuriant vegetation of the coast region. There is, however, a great variety of nutritious grasses and herbage, consequently the district is one of the very best for pastoral purposes. The operations of the well-borer's drill are everywhere met with, and numerous overflowing artesian wells are scattered far and wide over the face of the country. Most of the western district of Queensland, and very probably a great portion of the interior of South Australia, are covered by the water-bearing beds of the Lower Cretaceous formation. These are evidently developed over the whole of the rolling downs country, and consist of soft stratified rocks upon which the Desert Sandstone, or Upper Cretaceous formation, rests unconformably. The Government Geologist is of opinion that this Desert Sandstone must at one time have covered "at least three-fourths of the colony."[1] Being of exceedingly soft texture, it has undergone extensive denudation, and now occurs in the form of isolated tablelands, covered by a scanty vegetation of a type locally known as spinifex grass, and poorly-nourished timber. Opals occur in this formation, imbedded in the Desert Sandstone. They are distributed over a wide area of the district, but are probably found in greatest abundance south of Winton, in the Opal Range, and in the tableland separating the waters of the Diamantina and Mayne streams. Associated with the Lower Cretaceous beds of this region is a formation of soft grey

[1] *The Geology and Palæontology of Queensland and New Guinea*, Jack and Etheridge, p. 511.

friable sandstone grits and conglomerates, covered in places by the Desert Sandstone. To this highly porous, absorbent rock the name of Blythesdale Braystone has been given. It crops out over an area estimated to be about 5000 square miles, absorbs the rainfall greedily, and thus supplies the water-bearing beds of the Lower Cretaceous formation, that constitute the chief source of the valuable artesian water-supply of the district. In the north-west corner of the colony there occurs a development of Palæozoic rocks, which runs west into South Australia. From its eastern rim or apex, which coincides roughly with the 141st meridian, this ancient formation spreads itself out towards the north-west and south-east, crossing the western boundary of the country between the parallels of 24 degrees and a little north of 17 degrees. It is believed that these impermeable rocks are covered by the water-bearing beds of the Lower Cretaceous formation, but there is no satisfactory evidence in support of this view, which can only be regarded as tentative in the light of our present knowledge. It is somewhat significant that no true artesian water has yet been discovered within the area in question. The fossil drifts or Post-Tertiary deposits of Western Queensland have yielded abundant evidence to show that at one time in the geological history of the colony this district was occupied by several remarkable types of gigantic animals, of which the fossil-bones of the huge semi-wombat, *Diprotodon Australis*, the marsupial lion, *Thylacoleo carnifex*, the gigantic kangaroo, *Macropus titan*, the wombat, *Phascolomys*, the *Nototherium*, the alligator, *Palimnarchus pollens*, the moa, *Dinornis Queenslandiæ*, and many other remarkable forms of life of a bygone age, are the only remaining traces to be found. The molluscan fauna of this period, as indicated by the numerous fossil remains entombed within the Post-Pliocene drifts, shows unmistakably that in Post-Tertiary times there occurred extensive marshes, lakes, and wide streams in western Queensland and in central Australia. The rainfall, too, must at this time have been very great, and the climate altogether different from the present. The humidity was no doubt excessive, with high temperatures, that gave nourishment to a very rank and luxuriant vegetation, upon which these mighty animals of the period existed. Remarkable climatic changes, with corresponding ones in the physical aspect of the region, would no doubt modify the conditions of animal life and ultimately contribute to, or bring about, the total extinction of the fauna of that period. It may be of interest to note one or two particulars of these remarkable creatures of the past. The *Diprotodon* was a massive herbivorous animal about 10 feet in length and 6 in height. Its food consisted of the long and rank vegetation in swamps and on the margin of lakes. The marsupial lion was a large carnivorous beast, equal in size to the present African species. The gigantic kangaroo stood about 14 feet in height, and probably weighed a ton. The ancient wombat was an animal of enormous proportions. The *Nototherium*, a herbivorous creature, measured about 8 feet in length and 5 in height. The alligator, a dangerous saurian of the pool, attained a length of over 30 feet. The extinct moa was a wingless bird, of from 10 to 13 feet in height, and identical with the New Zealand species.

MERINO SHEEP AT JONDARYAN

Besides these there occurred many remarkable reptiles of imposing size, including an immense lizard of some 20 feet in length. In no period of the geological history of the country has there existed a terrestrial fauna so distinctive in character and restricted in geographical distribution as that which dominated the western portion of Queensland during "*Nototherium*" times—a name suggested for the age in which these prehistoric animals flourished by the accomplished curator of the Queensland Museum, Mr. C. W. De Vis. This institution includes, among other rare and valuable treasures, a very complete and altogether unique collection of the remains of the extinct fauna of that period, nearly all of which have been examined and determined by Mr. De Vis himself.

Mineral Wealth.

Queensland is the second gold-producing colony of Australasia, although the mineral industry has not yet advanced beyond the experimental stages, except in a few settled localities, where auriferous mining is now being carried on upon a somewhat elaborate scale. Several well-known gold-bearing areas are wholly undeveloped, and many extensive tracts within known metalliferous belts of country have not yet been prospected. At present there are altogether fifty-eight proclaimed goldfields, besides thirty-four mining districts. These are distributed over an enormous coastal region, extending throughout the eastern district, from the southern boundary of the colony to the far north, in Cape York Peninsula. There is no doubt whatever that the mineral wealth of the country is unsurpassed. Vast areas are yet unexamined, and untold treasures await discovery. There is actually no limit to the immense mineral resources of the territory, that now invite well-directed enterprise and sustained industry to contribute to their development. The gold-mining industry is divided into two very distinct branches—alluvial and quartz—each great in itself. During 1895 there were employed in these 10,636 miners, made up of 7764 quartz and 2872 alluvial miners. The yield of gold for the same period was 631,682 oz., and the total yield to 1895, from auriferous quartz and alluvial deposits, was 10,558,605 oz., equal in value to £36,955,117. These figures, remarkable as indeed they are, convey but a very imperfect idea to the ordinary mind of the enormous wealth extracted from the bowels of mother earth. If, however, we are allowed to indulge in what, after all, may be considered a simple scholastic demonstration, their actual importance may appear more striking. This quantity of gold, then, represents about 136,000 pieces the size of the monthly number of *The Scottish Geographical Magazine*, in which this paper is published. Or, to carry the comparison still further, it would make a rectangular beam of over 14,000 feet in length by over nine inches in breadth and six in depth.

Besides gold, other valuable minerals occur in many parts of the colony. These include copper, silver, antimony, and tin ores; coal, opal, gems, bismuth, wolfram, manganese, and lead. The quantity of these raised from 1860 to the end of 1895 represents a total value of

£8,949,284. This latter amount added to the former gives a grand total of £45,904,401, which represents the acquired mineral wealth of the country since separation from the mother-colony. The value of the gold and other minerals extracted from the rocks and soils of Queensland for the year 1895 was £2,435,657. Considerable as this sum may appear—and indeed is—each individual member of the entire population of the colony would only receive a trifle over £5, were it divided equally among them. If, however, the year's mineral revenue be regarded as representing the gross earnings of the miners themselves, it will be found that each man has earned for himself an equal share of about £185 for the year. This may be regarded as very satisfactory evidence of prosperity in the entire mining community, when it is considered that many of the men are only employed in mining for about half the year, or probably less, and that a great portion of the Chinese part of the population simply makes a bare living prospecting amongst old workings. The great Mount Morgan Gold-Mine is in the hands of a private company. It is one of the richest properties of the kind in the world, and up till the end of 1896 the mine had yielded 1,552,881 oz. of "the purest gold that has ever been mined," the Sydney Mint assays showing 99·7 per cent. of pure metal The actual output of gold for the year 1896 was 151,317 oz. The mine is situated some twenty-six miles south-west of Rockhampton, where the town of Mount Morgan shows every appearance of a flourishing centre of population, in which the mining element naturally enough predominates. It is believed that the auriferous deposit of this famous locality owes its origin to thermal action, "that," in fact, "the gold must have been precipitated in the ferruginous and siliceous sinter deposited by a thermal spring, which, charged with chlorine, dissolved the gold from the pyrites of the neighbouring reefs." The gold is extracted from the ores by a process of chlorination at a total cost of £1, 4s. 1·68d. per ton. The formation of the Mount is of Tertiary age.

Charters Towers is the richest and probably the most permanent known gold-field in the colony. It is situated about eighty miles from Townsville, and connected with that flourishing seaport town of the north by rail. Several of the mining shafts have been sunk to great depths along the line of reefs, which are remarkably rich in gold; and large dividends are being paid to shareholders. The town, which is naturally very prosperous, is inhabited by a large population of miners and business people. The output of gold on this field for the year 1895 was 230,704 oz. The Gympie Gold-Field, situated on the North Coast Railway Line, about sixty miles from the important coastal town of Maryborough, was discovered in 1876. At first it was a very rich alluvial field, but now gold-bearing reefs of exceptional richness and permanency have been found in great number. Its nearness to the capital of the colony and ample facilities of access have contributed greatly to the development of its resources, whilst the splendid agricultural and pastoral lands of the district give the town many advantages over most of the other mining centres of the country.

Owing to the very low market value of the metal, the copper-mining

TOWNSVILLE

industry receives but very little attention at present, although the ore occurs in enormous deposits in parts of the territory.

The well-known Ipswich Upper Trias beds have yielded an immense quantity of coal, since they were first opened up by the enterprising companies now engaged in the important industry. The actual quantity of coal raised from 1860 to the end of 1895 was 4,027,179 tons, valued at £1,837,323. Most of this has been obtained from the Ipswich coal-measures, which are developed over an area of some 12,000 square miles. Coal seams are known to exist in other localities, but the Burrum river outcrop of true Palæozoic coal is admitted to be the most important of all. It lies about fifteen miles north-west of the town of Maryborough, where several workable seams appear on the river bank. The coal is excellent, its quality being equal to that of the famous coal of Newcastle, New South Wales. There can be no reasonable doubt whatever that a most profitable industry could easily be established in the development of this coal-field. In the Ipswich district the cost of hewing is from 2s. to 3s. per ton.

Something has now been said of the minerals—much less than the importance of the subject demands—and a word or two may be given to other important themes. It has been clearly enough shown that the mineral resources of Queensland are not only vast, but practically inexhaustible. In point of fact, many of the proclaimed gold-fields have only yet been scratched on the surface, so to speak. Enormously large sums have been paid away by mining companies in dividends to shareholders, and it has been estimated, by the Permanent Head of the Mines Department, that in the case of one gold-field, at least, half of the annual output could likewise have been fairly distributed in dividends. The coal-beds are immense; they are largely developed in the eastern district along the coast-line, in localities easily accessible by rail and by water. All of the out-cropping seams may be wrought at a very low cost; most of the coal is of the very best quality, and there is every facility for transporting it to the principal eastern seaport towns, from Cooktown to Brisbane. Not only could the bunkers of the entire fleet of steamers now trading to Queensland ports be always stocked with coal from the mines of the colony, but large quantities could be exported after providing for local consumption. It is customary to say much in favour of the quality of the building stones of Europe and elsewhere, especially those used for ornamental purposes. We, indeed, possess a peculiar and very reprehensible faculty of underrating local commodities in favour of foreign ones. Building stones, it is true, are not yet in much demand locally, timber being mostly used for residential and business structures, the colony being all too young yet for more substantial and permanent erections. Marble, granite, and sandstone occur over a very wide range in Queensland, and they are of an excellent description. The first is found in very great variety, ranging from pure white to deep and rich colours in beautifully blended shades. The marble and the granite take a mirror-like polish, and they are unsurpassed in quality as well as in texture and beauty. Several very good samples of these valuable stones are exhibited in the local Museum at Brisbane, where full information

concerning them may be obtained. There can be no doubt that when the requirements of the country call for them, they will not only be found to fulfil all the conditions of first-class building and ornamental stones, but will likewise be a source of wealth to the colony. At present they are chiefly found in Warwick, Gatton, Northumberland Islands, Calliope river, Broken river, and Gladstone.

(*To be continued.*)

FORESTRY IN INDIA.[1]

By Lieut.-Colonel F. Bailey, (late) R.E.,

Formerly Superintendent of Forest Surveys in India, Director of the Forest School at Dehra Dun, Conservator of Forests in the Punjab, and Acting Inspector-General of Forests to the Government of India.

(*Read at the Meeting of the British Association in Toronto.*)

The principal physical features of the great triangular peninsula which, projecting from the margin of the Asiatic continent into the Indian Ocean, forms British India, are:—The Himalayan mountains, rising to a height of 29,000 feet, and forming its northern side; the low, fertile Gangetic plain, some 150 to 250 miles wide, stretching along the base of the mountain range from east to west, and merging into the Indus plain, which reaches to the western coast; and, to the south of this belt, the highlands of the peninsula proper, which, extending to its extremity, rise somewhat abruptly from the low plain to a height of 2000 feet, and attain their maximum elevation of 8760 feet near Ootacamund, in the south. The total area of British India, including the native states, is 1,560,160 square miles; and its 287 millions of inhabitants represent an average population of 184 per square mile.

India depends mainly for its rainfall on the damp south-western monsoon winds, which, on striking the elevated land, are forced upwards into cooler strata of the atmosphere, and effect their heaviest discharges off the west coast of Madras and Bombay, the west coast of Burma, and the eastern Sub-Himalayan region. The annual rainfall at Cherra Punji, in the north-east, has sometimes almost reached 600 inches, while in parts of Sind, in the north-west, the fall has been known to hardly exceed three inches.

There are over two thousand species of indigenous trees in India, as compared with only forty in Great Britain. The most important Himalayan forest-tree is the deodar (*Cedrus Deodara*), which forms considerable forests at an altitude of from 6000 to 9500 feet. The sál (*Shorea robusta*), the sissú (*Dalbergia Sissoo*), and the khair or cutch

[1] The following works have been made use of in the preparation of this paper:—*Distribution of Forests in India* and *Progress of Forestry in India*, by Sir Dietrich Brandis, Ph.D., F.R.S., K.C.I.E.; *Manual of Forestry*, vol. i., by Dr. Schlich, Ph.D., C.I.E.; *Review of Forest Administration in British India for the Year* 1894-95, by B. Ribbentrop, C.I.E., Inspector-General of Forests to the Government of India.

NORTH ISIS SUGAR MILL

FIELD OF PINEAPPLES

(*Acacia Catechu*), are the most valuable trees in the forests at the foot of the Himalayas, and they also occupy large areas in the central portion of the peninsula. In the latter region, as well as in Burma, are seen extensive forests of the highly valuable teak (*Tectona grandis*) associated with bamboos and other trees. The india-rubber tree (*Ficus elastica*) grows wild in the dense evergreen forests on the lower spurs of the Eastern Himalayas; it is found also on the Naga hills, which bound the Assam valley to the south, and in Burma. The strongly scented sandal-wood (*Santalum album*) occurs chiefly in the native state of Mysore, and in the surrounding districts of the Madras Presidency. Most of the forests contain bamboos, which are in great demand for building and many other purposes. The dry forests of Rájputána and the Punjáb produce chiefly jhand (*Prosopis spicigera*), jhál (*Salvadora*), and a leafless caper (*Capparis aphylla*); these forests gradually disappear in the deserts of Sind, which are devoid of arborescent vegetation.

Experiments have been made with a view to the introduction of useful exotic species into India; and fair success has been attained with the Australian blue gum, the olive, the rain-tree (*Robinia pseudacacia*), and a few others.

There is good ground for believing that in early times the greater part of India was clothed with forest; but that this condition should still prevail, no one — not even the most ardent forester — could desire. The disappearance of the primeval forest from most of the culturable land, and the reduction of the tree-cover over the grazing grounds required for the settlers' herds, can only be regarded as the necessary accompaniment of an increasing population, and a sign of their prosperity. But, unfortunately, the destruction of the forest has not been thus limited. When the population was much scantier than it is now, and far less well-to-do, their use of the forest outside their clearings did not seriously affect the vast woodlands by which these were enclosed. In course of time, however, not only were larger areas entirely cleared for cultivation and for village sites, but more numerous flocks and herds, driven for their daily food into the jungles, led to the gradual impoverishment of a forest-belt of ever-increasing width around the occupied tracts. And nomadic tribes, as well as settlers, recklessly destroyed immense areas of forest by annually, during the hot season, setting fire to the dry grass, fallen leaves, and dead wood, in order both to produce a crop of fresh succulent herbage for their cattle, and also to enable their hunters more successfully to pursue the game with which the forest abounded. In some districts, especially in hilly tracts, when this practice, together with those of over-cutting and of extracting roots for fuel, had completely done away with the protecting forest growth, and when the heavy rains had commenced to wash the fertile soil down into the ravines and valleys, it was no longer found possible to maintain cows and bullocks in good condition on the scanty herbage that remained for them to pick up; and the villagers then began to keep large flocks of goats—animals who can climb anywhere and eat anything, but have a special liking for young trees and shrubs, and against whose hoofs and teeth it is well known that forest growth cannot contend.

The destructive system of temporary cultivation, which still prevails extensively in several mountainous regions, has also materially accelerated the disappearance of the forests. Under this system the trees are felled, and the resulting mass of timber, with fallen leaves and twigs, grass and other herbs, is burnt as soon as it becomes sufficiently dry; and when rain falls, the loose forest soil, manured by the ashes, is sown with grain, which yields abundantly without tillage. In some places it is the custom to take off a second crop before abandoning the temporary field, but more commonly the patch is quitted after a single harvest, a fresh piece of forest being then taken in hand; and, as the very best soil is selected for this barbarous treatment, the result has been that large areas of the most valuable forest have been ruthlessly destroyed by it. Under British rule the people of various races and tribes, who had previously lived in mutual strife, began to enjoy a hitherto unknown rest, quietness, and sense of security. Their increased prosperity was marked by a rapid extension of the cultivated area, and by a consequent and proportionally quick disappearance of the forests; and the process of denudation was hastened by an improvement in the style of their dwellings and in their manner of life, which led them to use more wood, and wood of a better quality than had previously satisfied their wants. Then followed a demand by the State for timber for the construction of railways, canals, bridges, barracks, and other public works, and for firewood for use in railway engines and in lime-kilns; and it soon began to be apparent that the resources of the country in wood, hitherto assumed to be inexhaustible, had been thoughtlessly and ignorantly reduced to a condition in which they could no longer be relied on for the needful supplies.

Had it been found possible to regulate the increasing clearances from a comparatively early stage in their progress, and to apply effectual protection and skilful management to the forest areas not required for cultivation, to what a magnificent heritage would present and future generations have succeeded! But reckless cutting, burning, and grazing did their work thoroughly; and by the time our rulers had realised the extent to which denudation had been carried, forests were, for the most part, to be found only where favourable conditions of rainfall and temperature had enabled a more vigorous growth to withstand the ill-usage to which it had so long been subjected, or in the comparatively limited regions to which the newer development had not reached. Some notable exceptions, however, occurred in Sind, the Punjáb, and some other provinces, where the native chiefs had reserved and protected certain forest tracts, principally as hunting grounds.

It has not been proved that denudation has produced an unfavourable effect on the climate generally. India depends for the greater part of its rainfall on the wet current of the south-west monsoon, the force and degree of dampness of which would not be increased by an extension of the area under forest; but it is, nevertheless, quite possible that forest conservancy may have an influence on local precipitations, and experience gained in the Central Provinces seems to indicate that such is the case. We know, at any rate, that dew is heavier in the vicinity of forests than in the open country; and, partly on this account, densely stocked shelter-

belts materially benefit the cultivation which adjoins them, while, especially in and on the borders of the drier regions, every wood and grove of trees is a valued boon on account of the shade it affords both to men and to cattle during the hot spring and summer days.

But there can be no manner of doubt that dense forests reduce the loss of moisture by the soil through evaporation; and this is an important advantage where the rainfall is limited or is unfavourably distributed over the year. Such forests, especially when they grow on hilly ground, also regulate the drainage; for the crowns of the trees break the force with which the rain strikes the ground, while the leaves, moss, and other decaying vegetable substances on which it falls not only act as a sponge by absorbing water and arresting its flow over the surface, but they keep the soil below them loose and permeable, so that the water, which gradually trickles down through the soil, easily finds its way into the earth, to reappear lower down in the form of springs, or to raise the water-level in wells, instead of flowing rapidly off into the channels of natural drainage, and thus escaping without much benefit to the soil on which it fell. Hence it is that a stream rising in hills clothed with dense and well-protected forests runs more regularly, and is less subject to floods than when its catchment basin carries an open, imperfectly stocked cover, and when the accumulation of decaying leaves and herbs is prevented by annual fires. The destruction of forests in India has certainly resulted in the drying up of springs and streams which took their rise within the denuded area, and this is a consideration of importance, especially in those parts of Central and Southern India which are irrigated by canals led from rivers which, unlike those of Himalayan origin, do not draw their main hot-season supply of water from the melting snow of the higher ranges. Irrigation reservoirs, fed by dammed-up streams and by springs, and wells dug in valleys, also benefit largely by a dense forest growth on their catchment area. Twenty-seven millions of acres in British India are thus irrigated, either by canals which are not snow-fed, or from reservoirs and wells; and it has been proved that, except in the most arid regions, protection from excessive cutting and grazing, and from fire, suffices to produce a markedly favourable effect on the water supply.

It is, moreover, certain that from hilly ground covered with forest less soil is washed away, and less silt is carried down rivers and deposited in their lower reaches. If the hills are bare, the rain-water rushes down their slopes in torrents, carrying with it not only the surface soil, but also stones and boulders; it then breaches embankments, silts up rivers, and interferes with their navigation. All over the moister and more densely populated regions of India effects of this nature are visible; but it will suffice to cite as an example the outer Himalayan spurs in the Hoshiárpur district of the Punjáb, where, as the rock is very friable, the damage has been exceptionally serious. Within the memory of living men these hills were covered—to a great extent at any rate—with a dense forest of trees or with tall grass, and the streams issuing from them ran evenly in well-defined channels. But the natural vegetation has now almost entirely disappeared, the hills are gradually crumbling away, and

the loose rock of which they are composed is being carried down and deposited on the plains below by streams whose stony beds, dry except during the rains, are often several hundred yards wide. Thus, not only have the hills themselves become a dismal and profitless waste, but the fertility of extensive areas of cultivation near their base has been completely destroyed by the stony deposits laid over them; and the evil is still in active operation. This state of things has been gradually brought about by over-cutting, and by excessive cattle-grazing, with burning, followed by the substitution of goats for cattle from the time when the quality of the pasture became too poor for the support of the latter kind of stock; and there is only one way in which the process of disintegration and destruction can be checked, namely, by the prohibition of all grazing, and especially by the exclusion of goats and sheep. There is no doubt that, if this were done, the hills would even now gradually reclothe themselves with grass, shrubs, and trees; and the efforts of Nature in this direction might be assisted by sowing and planting in the least unfavourable localities. There are many other cases of sufficient importance to justify special measures for the protection of roads and bridges in hilly tracts, and to prevent the formation of ravines, the silting up of rivers, and other mischief following on denudation.

The awakening of the authorities to the situation created by continued forest destruction was a gradual one. In 1839-1840 the Government of the Bombay Presidency stopped the cutting of teak-trees on Government property. In 1843 Mr. Conolly, Collector of Malabar, in the Madras Presidency, began to plant teak on a large scale at Nilambar: in 1847 Dr. Gibson was appointed Conservator of Forests in Bombay; from 1848 to 1856 Lieutenant (now General, C.S.I.) James Michael conducted the Government timber operations in the Anamalai teak forests (Madras), and made the first recorded attempts to protect Indian forests from injury by annual jungle fires; he was succeeded by Captain Hamilton who, in his turn, was followed by Lieutenant Beddome. In 1856 Dr. Hugh Cleghorn, whose attention had for some years previously been attracted to the urgent necessity for measures of forest conservancy, was appointed Conservator of Forests in Madras. He checked the destructive practice of temporary cultivation in the Government forests of that Presidency, a measure which, though strongly opposed by the people, he knew would in the end prove highly beneficial to them. He was successful in this important and difficult task, because his well-known desire to promote native interests inspired the rulers of the country with confidence in his proposals. In 1856 Dr. Brandis (now Sir Dietrich, K.C.I.E.) was sent out as Conservator of the newly acquired province of Pegu (Burma), and in 1864 was appointed Inspector-General of Forests to the Government of India, in order to advise the supreme Government and the various provincial Governments and Administrations regarding the organisation and management of forest business.

From that time forward forest questions in all parts of the Empire received consideration at the hands of the Government, and during the twenty years that Sir Dietrich held his important office, he was, by the exercise of his far-seeing judgment and by almost superhuman labour, enabled to

organise forest conservancy on a sound basis throughout Her Majesty's Indian dominions. This great result has been accomplished in face of discouraging opposition from many influential quarters—an opposition springing from a keen sense of the duty laid on those charged with the administration of the country to protect the people against undue interference by Government with long-established customs, which were regarded by them as inalienable rights. It is only natural that this feeling should have prevailed in the minds of the officials in daily contact with the villagers who would be immediately affected by any restrictions and irksome regulations that it might be sought to introduce. For, although the destruction of forests by over-cutting, over-grazing, and burning is sure, even in a warm and moist climate where growth and reproduction are vigorous, it is also gradual; and the disastrous results of such treatment were not then generally foreseen. The British officials had no opportunities at home of learning anything of the subject, and there was practically no literature in our language relating to it. From year to year the country seemed to present an unaltered appearance; and it is therefore not surprising that credence should have been given to representations that not only were the usages complained of necessary to the continued prosperity of the native inhabitants, but that the forests had always been as they then were; nor can it be wondered that the Inspector-General of Forests and his staff were sometimes regarded as over-zealous officials, against whose uncalled-for interference the people needed protection. Unfortunately, this feeling has not even yet everywhere died out.

But when the Government had fully realised the necessity for a regular system of forest management, which would secure in perpetuity the advantages arising from the preservation of considerable areas of forest to supply the wants of the people in the way of timber, firewood, and other forest produce—a system which would at the same time, by arresting the denudation of hills, secure the permanence of springs and streams having their sources within them, and benefit the country in other indirect ways—the first difficulty it encountered was an uncertainty as to what power it possessed over the areas it desired to take in hand. In India, as in other parts of the world, the inhabitants of the towns and villages within and on the borders of the natural forests had from time immemorial, and without restriction, cut timber and firewood, collected grass and other forest produce, grazed their herds and flocks, fired the forest to produce fresh crops of green and nutritious grass, and broken up land for temporary, or even for permanent, cultivation; and these usages, the extent and results of which had forced the Government into action, had come to be admitted as rights. It was, indeed, very difficult to look upon them in any other light. To have summarily ordered their prohibition would have been both unjust and impracticable; and the only course open to the Government was to determine, in the first place, what areas were the property of the State, and then either to free them from the rights with which they were admittedly burdened, or, where this could not be accomplished, to define the rights and regulate their exercise, so that they might not be liable

to extinction through the destruction of the forests over which they existed.

It was evident that, until this were done, neither would the process of destruction which had proceeded at so alarming a rate be checked, nor would the introduction of systematic management be possible. The work of "settlement" could not, however, be carried out all at once; it was one involving much time and patience, and conciliatory treatment of the people immediately affected. It was not to be expected that they would see the necessity for the restrictions imposed upon them, or that, even if they could be convinced on this point, they would willingly make personal sacrifices in the interest of posterity, or on grounds of imperial policy. They could hardly be blamed for thinking that existing conditions would last long enough for them individually, and that posterity might occupy itself with the cares of the future. But the Government could no longer leave events to take their course, for it had become fully convinced that however much forest conservancy might be opposed, it formed the only means of securing permanent sources from which the right-holders could draw their supplies; and the Government was satisfied that conservancy would thus eventually promote the wellbeing of the people most affected by its accompanying restrictions, while it would, moreover, prove a benefit to the country at large.

Existing legislation, however, did not suffice; a special law was wanted, and in 1878 the Indian Forest Act was passed. This Act, which has since undergone some modification, provides for the formation of Reserved Forests, after a full inquiry by a Forest Settlement Officer into all claims to rights therein. The exercise of admitted rights must then be provided for; or, if this be found impossible (with due regard to the maintenance of the forest), they must be commuted for a money payment, a grant of land, or some other equivalent. There has been an undoubted tendency on the part of Forest Settlement Officers in some provinces to provide for a possible future increase of the population and of their flocks and herds by recording vague and indefinite rights, which leaves the forest liable to be destroyed by an amount of cutting and grazing far in excess of its capability, and which thus renders the settlement of no practical effect. But the great and important work of forest settlement has on the whole made satisfactory progress, and it is now approaching completion in several provinces.

The special Forest Law prohibits certain acts which cannot be suitably dealt with under the ordinary law, and prescribes punishments, which include the closure of a forest for such period as the Government may think fit against the exercise of all rights to pasture and forest produce; and it also lays down the procedure to be followed when dealing with forest offences. Under it, forest officers may be specially empowered to accept compensation from persons against whom a reasonable suspicion exists that they have committed an offence; and this forms an easy way of dealing with petty thefts and misdemeanours, without requiring the offenders and the witnesses to travel long distances to appear before a magistrate, and thus causing them an amount of inconvenience and loss of time wholly out of proportion to the damage they

may have done. If judiciously worked, the system is a good one for the early days of forest conservancy, before the people have fully realised the nature of recently introduced restrictions, and when they may be liable to err through ignorance or inadvertence in a way which cannot be regarded as criminal.

In addition to Reserved Forests the Act provides for the formation of Village Forests; and it deals also with many other matters, in regard to which special legislation was found necessary. Forest Acts have been passed for Burma and for Madras; and Forest Regulations have been issued to meet local requirements in various parts of the country.

The total area of territory under British administration is 964,993 square miles, and the Native States cover an additional 599,167 square miles. It has been generally acknowledged that, on account of the difficulty of exercising control over forests in the hands of other proprietors, the State should retain as many as possible of the more important forest tracts in its own hands. In pursuance of this principle, which has special force in India, 74,271 square miles in British territory have already been set aside as Reserved Forests, or permanent forest estates, which are being gradually brought under rational treatment; and an additional area of 38,681 square miles is provisionally subjected to a limited protection. The total area under charge of the Indian Forest Department is, accordingly, 112,952 square miles, which, however, include 1327 square miles leased for a definite period from native chiefs. In addition to these domains, there is a very large area of land carrying a crop of trees of some kind or other. A part of this is private property, over which the State has no control except in very special cases that rarely arise; but there is no doubt that in course of time considerable additions will be made to the lands under the Forest Department, and especially that the area of Reserved Forests will be much increased. It is probable that a part of the still unprotected area will be formed into Village Forests, to be managed for their own benefit by village communities under State control; and that a part will be permanently devoted to pasture, or be leased for the extension of cultivation. A large number of the State forests have not yet had time to recover from the ill-usage to which they were formerly subjected, and are still in an exhausted condition; while many are burdened with heavy wood-cutting, grazing, and other rights. Such forests are of course not in full yield; and throughout the State forests a heavy expenditure has still to be incurred on sylvicultural works of improvement as well as on demarcation, survey, roads, buildings, and the clearing of stream-beds for the floating of timber. For this work a large and costly establishment has to be maintained.

A first condition of effectual management must be that the forests are demarcated in such a manner that, on the one hand, the officials in charge of them may know exactly the limits of the property for which they are responsible; and, on the other hand, that villagers, herdsmen, and others may be able clearly to distinguish the line beyond which they cannot cut and collect forest produce, or drive their herds and flocks to pasture without permission. The Government forest boundaries are

60,821 miles in length, of which 10,191 miles do not require artificial marks, 44,889 miles have been demarcated, and 5741 miles remain to be dealt with.

When a commencement was made to introduce a regular system of work into the Government forests, occupying for the most part rugged waste lands for which surveys on a very small scale had previously been deemed sufficient, it was found necessary to provide more detailed maps for the officials charged with the preparation of administrative schemes, as well as for the use of those who were to carry these schemes out; and, in 1872, the Government of India intrusted the preparation of such maps to a special branch of the Forest Department, which was placed under the general guidance, in professional matters, of the Surveyor-General of India. Since that year the work has steadily progressed, about 16,000 square miles having been surveyed and mapped by the Survey Branch, while parties of the Imperial Survey Department, which have gradually become available for this duty, have completed about 17,500 square miles, so that the area for which adequate maps have now been provided amounts to 33,420 square miles. Of this area, 25,206 square miles have been surveyed on the scale of $4'' = 1$ mile, and 3201 square miles on larger scales.

The working of the forests could not have been carried on without a very large and costly addition to the number of routes practicable for the transport of produce. In many cases cart-roads have been constructed, not only within forest boundaries, but to considerable distances beyond them. Elsewhere, especially in mountainous districts, the timber is floated down streams and rivers, obstructions in the beds of which have been removed to enable logs and railway sleepers to pass down with the current. Such obstructions saved many a fine forest from the destruction that overtook its more accessible neighbours; but when the Government officers had shown how obstacles of this nature could be dealt with, and how the timber growing in remote mountain forests could be cheaply and expeditiously brought to market, a number of dealers arose, who hastened to buy from the native chiefs the right to work out their timber. The rates offered and accepted were extremely low, and the profits made by the dealers were correspondingly high; but the chiefs had not previously regarded their trees as saleable property, and jumped at a sum of ready money paid down for them. They knew nothing, and in many cases cared less, about the effect that wholesale fellings—made without regard to regeneration—might have on the very existence of their woods, and consequently on the welfare of the inhabitants of their States; for the people relied on the forests for the materials with which to rebuild their wooden houses, for fuel, for agricultural implements and other purposes; and—though they did not think of this—for the maintenance of their water-supply. It might well be doubted whether the chiefs had the right thus to dispose of the birthright of their successors and their people in exchange for a mess of pottage in the shape of a few thousands of rupees, to be squandered in marriage feasts and similar extravagances; and as soon as the Government became aware of what was going on, it stepped in and entered into

agreements with some of the chiefs, leasing their forests from them for a term of years in consideration of an annual payment as rent. This measure has secured not only the continued existence of these forests, but their gradual improvement during the period covered by the lease; and it may reasonably be hoped that when the leases expire they will either be renewed, or that the chiefs will have become convinced that it is in the interest both of themselves and of their people to carry on the system of management inaugurated by the Government officers.

The extension of the railway system over the peninsula has rendered saleable the more valuable classes of produce from many forests that were previously inaccessible; but the smaller timber and "minor produce" in such places, and even timber of the largest dimensions in others—*e.g.* the spruce and silver fir in the Himalayas—will probably remain practically valueless for a long time to come on account of the great expense involved in bringing them to market, and the low prices which they command.

Much has been done to provide suitable accommodation for the resident Range Officers and their subordinates, and also in the way of building rest-houses for the use of the Controlling Officers when they are marching about their districts. Such shelter is a necessity for European officers when engaged in "fire-conservancy" during the hottest season of the year, and when they are compelled to be in their forests during the rains.

When dealing with an extensive crop of trees, which, in order that they may attain the most useful and valuable dimensions, must, in most cases, stand upon the ground throughout the working lives of several generations of foresters, and when the value of the standing crop increases year by year, while the ultimate financial result depends on the skill with which the crop is treated throughout the long stages of its growth, it becomes a matter of vital importance that the objects of management should be clearly laid down, and that they should be kept steadily in view by successive officials, so that all work may be directed towards the production of the largest quantity of wood of the kind most desired. The age at which the crop will best fulfil these objects must be ascertained, and a scheme of fellings must be drawn up, so that portions of the forest, having successively attained the prescribed age, may be cut down annually or after a fixed interval of years, and may thus afford a steady yield to the owner in material or in money. Further, all work, such as that connected with regeneration, thinning, and protection from fire and other injuries, must be arranged in some detail for a few years in advance. An administrative scheme or project such as this is called a *Working Plan*; and unless such a plan has been drawn up and sanctioned, and unless provision in money and otherwise has been made for the carrying out of its prescriptions, it cannot be expected that the best results, or, indeed, a much less measure of success, will be attained. Unless it be clearly laid down what, with due regard to the rate of production and the necessary improvement of the condition of the crop, the annual or periodical fellings ought to amount to, there can, where a sufficient demand exists, be no certainty that the fellings

will not exceed this amount, and include a part of the growing or producing stock. Should the fellings be excessive for a long enough period, the forest must of course disappear. And since the producing stock or wood-capital is indistinguishable by its appearance from the yield or wood-interest, which ought to limit the cuttings, the process of excessive felling may be carried on unnoticed until the impoverished condition of the crop forces itself on the attention.

The Government of India, therefore, commenced many years ago to prepare working plans for its more important forests, and, excluding Madras and Bombay, 9423 square miles of forest, or twelve per cent. of the total area under charge of the Forest Department, are now managed under sanctioned plans. The work is progressing rapidly, and the area systematically managed is year by year considerably increased, while the value of the forests is at the same time greatly enhanced.

After the summer rains the whole country begins to dry up, and continues to do so throughout the winter months; and as the spring advances, the moisture in the soil becomes so much reduced as to bring about the annual season of repose for arborescent vegetation. At this time the leaves fall from the trees and cover the ground, the grass and herbs dry up, and as the sun gains more power they become as dry as tinder, when a single spark may suffice to cause a conflagration extending over many square miles of country. Some forests, such as the evergreen forests of the moister regions, are practically exempt from burning, while others are so constituted, or so situated, that they escape in all but exceptional seasons of heat and drought; but over vast areas in the plains and lower hills fires have passed annually from time immemorial.

Such fires are kindled either by herdsmen, whose object is to burn off the old coarse and dry grass, and thus obtain a green and nutritious crop for their cattle; or by native hunters, whose aim is also to produce stretches of young grass, which in this case are intended to attract the deer to open places where they may be easily seen and shot; or by persons burning portions of the forest in order to raise crops on the ground manured by the ashes; or by collectors of honey when driving the bees from their nests by smoke, by travellers leaving the embers of their cooking-fires to smoulder, by sparks from railway engines, or in other ways. Fires ignited outside the forests are often allowed to spread into them, the people being thoroughly careless, and giving no thought as to the distance to which the flames they kindle may spread; and there is no doubt that fires are sometimes lighted maliciously, either without or within the boundaries, in order to spite the forest officials, or as a protest against recently introduced restrictions. In some cases, it has doubtless been hoped that, by repeated burning of areas sought to be protected the patience of the forest officers would be worn out, and that they would thus be induced to abandon their intentions and to readmit cattle to graze over the ground.

So accustomed were the people to fire the woodlands, and the civil officers to seeing it done every year, that the practice came to be accepted as a regular part of the rural system, and when the forest officers desired

to check the custom in certain places, it was considered wholly impossible either to prevent the outbreak of the fires or to deal in any way with the conflagrations into which they developed. It was also said that the firing of the forests was necessary, both to provide pasture for cattle and to protect agricultural crops from the depredations of insects which the unburnt forests would harbour; and it was even urged that the burning was not only harmless to the forests themselves, but was actually productive of the best possible results as regards the growth of the trees on the ground.

The wish may perhaps have been father to the thought! At any rate, the theory was a convenient one in face of the obvious difficulties, physical and administrative, which opposed themselves to any attempt at dealing with the gigantic evil. But there can be no doubt that it was wholly false. The fires passing annually, or at intervals not much exceeding a year, through the forests, burned up the young seedlings and coppice shoots, along with the seed of species which ripened early; they consumed the leaves and herbs which, if left to decay upon the ground, would have kept it loose and moist, and they left instead a dry, hard, and baked soil. This became all the harder and drier, because, under the baneful influence of the fires, the shelter afforded to the ground was reduced by the disappearance of many of the trees, and by the leafless season of the remainder being unusually prolonged. Then, a very large proportion of the ash resulting from the burning was lost to the soil, as it was washed away into ravines and hollows by the first heavy rain.

Under the system of annual burning the forests subjected to it were, if not destroyed, reduced to the condition of a thin scrub, with a small number of old trees standing over it; these grew slowly, were often gnarled and misshapen, and a very large proportion of them became hollow through injury to the bark, which left the wood exposed to the air and to attack by fungi. In the sál (*Shorea robusta*) forests of the North-Western Provinces it was common to see areas annually burnt over producing with equal regularity a crop of coppice shoots which could never live for more than a year. The portions of stem just below the surface of the ground which produced these shoots were often of surprisingly large size, showing the marks of several scores of successive annual shoots that had been burnt down after a single season's growth.

The first successful attempts to deal with forest fires were made in 1864 by Major (now Colonel) G. F. Pearson, who was then Conservator of Forests in the Central Provinces, and who devised a system of cleared "fire-lines" or "fire-traces," which were cut and burnt early in the season around the areas he wished to protect. The system thus introduced has extended all over India, and "fire-conservancy" now forms one of the most important and responsible duties of the forest officials. Unfortunately for them it has to be carried out during the very hottest season of the year, and involves an amount of exposure which is trying to the health. The nature of the protective measures to be undertaken against fires varies with the circumstances of each case. Where the grass is short, and the locality is not subject to high

winds blowing towards the area to be protected, cleared lines 25 to 35 feet wide will, generally speaking, suffice; but such lines may be useless under opposite conditions, and for lines 100 feet or more wide, the preparation will be relatively costly. Where dead leaves take the place of dry grass as the combustible substance on the ground, they must be swept up, perhaps more than once during each season of danger.

But in spite of the great administrative difficulties encountered, and the seeming impossibility of coping with vast forest conflagrations, the success of the Department in suppressing them has been remarkable. During 1894-95 the area over which protection was attempted extended to 30,963 square miles, of which no less than 28,913 square miles were actually saved from burning; and the average cost of the year's work was only $2\frac{2}{3}$ pies, or one third of a penny, per acre. The area under protection from fire then amounted to nearly one-third of the total area for which the Forest Department was responsible, and it is being added to year by year, care being taken to leave open to grazing an area sufficient for the herds of the people. In the protected forests the cover has become more dense, and this has led to the killing out of much of the coarse grass, and the substitution of a greener undergrowth of herbs, shrubs, and young trees; it has also induced a moister and less inflammable condition of the dead leaves upon the ground. The result of this, with other forms of protection, has been that over extensive areas the poor, thin jungles of former days are gradually being converted into well-stocked forests, and are already yielding a large and steadily increasing revenue.

The injury done to forests by grazing, both directly and in consequence of the conflagrations which the practice leads to, is very great; and especially is this so when the animals are camels or goats, which browse young trees in preference to cropping grass and herbs, and whose admission into woods is held to be incompatible with the permanent maintenance of a crop of trees on the ground. If the grass required for cattle could be cut and removed for their use, this would be more advantageous from an economic point of view than driving them into the forests to pick it up for themselves; but such a system cannot be generally adopted, both on account of the labour it would involve, and because the custom of grazing has prevailed from time immemorial, and cannot be broken through all at once. But the Government has always recognised that the State forests, which are being gradually brought nearer to the inhabited areas by the reservation of additional tracts, and by the extension of cultivation towards the boundaries of the old reserves, must be managed in the manner most conducive to the well-being of the population. And, seeing that there are stages in the growth of every forest during which judiciously regulated grazing does comparatively little harm, it has been arranged that, apart from the question of legal rights, the maximum area that, consistently with rational treatment of the woods, can be made available, shall be opened to the flocks and herds of the neighbouring towns and villages requiring it, and in some cases to those of nomadic herdsmen also. A portion of the animals grazing are admitted free by right of their owners under the forest settlement; others are so admitted during the pleasure of the Govern-

ment, or otherwise than under settlement; while for the remainder fees are levied, especially low rates being conceded in certain cases. Reservations on a large scale, with the special object of providing cattle-fodder—not trees—are contemplated in the drier regions of Northern India, where grazing restrictions are found very difficult to enforce. Of the total area (112,952 square miles) under charge of the Forest Department, 32,772 square miles are closed to all animals, and 22,245 additional square miles are closed to camels and goats only, cows and bullocks, and also sheep, being admitted.

The protection afforded to the forests, principally by the exclusion of fire and of flocks and herds, has nearly everywhere, except in the very dry parts of the country, and in places subject to severe frost or overgrown with dense, tall grass, resulted in a vigorous natural crop of seedlings or of coppice shoots, or both; and these have made satisfactory progress where the conditions are not unfavourable. But measures of forest conservancy, making no distinction of species, benefit those for which there is at present no market equally with others which constitute the more valuable elements of the crop; and on this account, as well as because the proportion of the older seed-bearers of the latter class of species is frequently far too small, it has been found necessary, in many woods, to undertake cultural operations with a view to the improvement of the constitution of the mixture. With this object, additional young plants of deodar, teak, and other valuable trees have been introduced by sowing and planting, saplings of inferior kinds have been cut back, and large trees of such species standing over young growth which it is desired to encourage have been girdled, so as to permit the latter to spring up vigorously under the influence of increased light. Climbers grow to an immense size in some parts of the country, where, mounting to the summit of a tree, they spread themselves out over its crown and over the crowns of its immediate neighbours, crushing the life out of them by their heavy shade and their enormous weight. The climbers have been repeatedly cut, and have by degrees been killed out in many forests.

But in addition to cultural work such as the above, it has been found necessary to form regular plantations, in order to fill up extensive blanks in existing woods, and to stock bare ground in the plains and in the hills where it may be necessary to establish forests for the supply of a special demand, or to make existing forest blocks more compact, and thus facilitate their economical management and effectual supervision. Such plantations cover 120 square miles, and, in addition, an area in Burma of 56 square miles, consisting of plots cleared by natives for temporary cultivation, have been stocked by the tribes abandoning them, under a system of Government rewards originally suggested by Sir Dietrich Brandis, and successfully introduced by Major Seaton in 1868.

The demand for timber, firewood, and other forest produce for the use of the native population, and for the construction of railways, canals, and public buildings, is, of course, enormous; and unless measures had been taken to arrest the process of destruction previously described, and

to bring the surviving forest tracts under systematic management, there would have been no chance of the supply grown in the country being sufficient. As Sir Dietrich Brandis has observed, "the law that increased demand will always produce increased supply does not hold good when the supply requires a hundred years to become available." Yet home sources must be relied on; for, although large numbers of the sleepers used on railways continue to be imported from Europe, and are laid down to a considerable distance from the sea-coast, the transport by rail of such heavy and bulky merchandise as wood is so costly as to prohibit the general use of foreign-grown timber in the interior of the country, even supposing that the markets could be supplied from abroad. Coal is not available as domestic fuel, and where wood is used for this purpose it must evidently be obtained locally. If the area under forest were extended by the formation of additional reserves, so situated that the bulk of the population could obtain firewood from them at a very cheap rate, it might be hoped that the present widely prevailing practice of burning cow-dung as fuel, instead of using it as manure, might gradually be abandoned. But old customs die hard; the people have the cow-dung ready to hand without payment, and on this account will doubtless continue to burn it for a long time to come.

In addition to vast quantities of timber and other produce collected by right-holders, the Government forests yielded in 1894-95 over 45 millions of cubic feet of timber, over 97 millions of cubic feet of firewood, nearly 134 millions of bamboos, and "minor produce" to the value of nearly $3\frac{1}{4}$ millions of rupees. Less than one-third of the timber and firewood was removed by Government agency, the remainder, with nearly all the bamboos and minor produce, being taken out by purchasers on permits granted by the Department. As the forests become better opened out and communication with the market less difficult, collections by Government agency will gradually give way to those made by purchasers themselves, the latter mode being preferred, as by it the produce can be placed on the markets in the greatest quantity and at the lowest price.

But even the above-mentioned large quantities of wood, bamboos, and other articles taken out by Government for its own use or for sale, or removed by purchasers, added to those consumed by right-holders, do not represent the whole annual production of the forest domains, many of which have not yet sufficiently recovered from former ill-usage to permit of their being yet drawn upon for the full amount of their annual increase. Many of these estates are, moreover, so remote, and are still so inaccessible, that none but the best pieces of the most valuable species can be profitably taken to the distant markets; while in such places the local consumption is extremely limited. And even in more favourable situations, where the demand for certain higher classes of wood exceeds the production, firewood is frequently left to rot on the ground. Other forests again are maintained to secure the water-supply in rivers and streams, reservoirs and wells, used for irrigation; and their preservation must be continued even though there be no present means of disposing of what grows in them. But as the forests, under the influence of protection

and good management, year by year approach more nearly the condition of maximum yield, it will become more and more important to develop markets both for produce of kinds not in demand for the domestic and agricultural uses of the native population, and also for that growing in localities where the production is in excess of the demand. This is recognised as a difficulty which will only be very partially met, should the old native industry be revived, which, by the use of charcoal, produced iron and steel of excellent quality.

Exports are, however, of growing importance; and in 1894-95 56,495 tons of teak wood, a considerable quantity of sandalwood, ebony, and other ornamental woods, with minor produce such as caoutchouc, lac, cutch and gambier, myrabolans and cardamoms, the whole valued at nearly thirty millions of rupees, were shipped to foreign ports.

The formation of State forests and their methodical management has not only secured the supply of free grants of forest produce, now valued at some six millions of rupees per annum, to the native population, but has enabled them to satisfy their further requirements at reasonable rates; and it has also provided large quantities of timber for use on public works. And the State forests now steadily yield a surplus revenue, which will increase when they have fully recovered from their formerly impoverished condition, and when it is no longer necessary to expend so much on works of development, organisation, and improvement. During 1894-95 the gross revenue was Rs. 16,788,880 and the surplus was Rs. 7,415,590.

The work of the Department is performed by the Imperial, the Provincial, the Subordinate, and the Protective Services. The officers of the Imperial Service form the Controlling Staff, from among whom are selected the chief forest officers (Conservators) of the various provinces, the officers charged with the preparation of working plans, and the professors of the Forest School at Dehra Dun. For the past thirty years it has been recognised that these officers, whose number is, and always will be, very small, must, after a good general education, including the study of selected branches of natural science, be made thoroughly familiar with forest administration as carried on in countries of the European continent. In those countries, large forest domains, either the property of the State or under State control, are managed on a regular system which is the outcome of centuries of experience; and for a period of about twenty years the candidates for the Controlling Staff received their professional training in the Forest Schools of Germany and France. During the past twelve years, however, they have been trained at Cooper's Hill College, in England; but a considerable portion of their time is still spent abroad, where arrangements have been made for their practical instruction. These are the men with whom it rests to build up a system of forestry suitable to the peculiar conditions prevailing in the various parts of the Indian Empire; they are not called upon merely to direct their large staff of subordinates in extensive works of sylviculture, forest protection, and utilisation, but, in communication with the civil officers of districts and the higher officers of Government, they have to deal with all matters in which the forests and their management affect the native

population. Such matters are, for example, the selection of additional reserves, records of right to pasture and to collect produce, with the manner in which such right may be exercised, forest laws and regulations and the way in which these are applied. For the efficient discharge of such functions, the officers of the Imperial Service should not only have received the best possible professional training, but they should be men with broad views, whose opinions and recommendations will carry weight with the high officials in whose hands the ultimate authority in such matters rests. Had not the Government of India availed itself of European experience for the training of its highest class of forest officers, the work now accomplished by the Department could not have been done.

At the present time the Imperial Service consists of 1 Inspector-General, 13 Conservators or chief provincial forest officers, 1 Assistant Inspector-General, 4 professors at the Forest School, and about 170 deputy and assistant conservators, who are for the most part employed in charge of the "divisions" or groups into which the forests of the various provinces are apportioned; while a small number are on special duty in connection with the preparation of working plans. Several of these officers have from time to time been lent, temporarily, to colonial governments, and a few of these have been permanently retained in British colonies; one such officer is now in charge of the forests of the Kashmir State, and another is organising the forests of Siam.

The Subordinate Service consists of Forest Rangers, who are in executive charge of the "ranges" into which the divisions are split up. They are, for the most part, natives of India of the dark races. There are over 300 of such men in the permanent service, besides temporary hands; but this number, which is already found insufficient, will no doubt be gradually increased as the work of the Department becomes more intense, and as additional forests are, by careful management, brought into full yield. These men form the "backbone" of the Department, and their professional training is essential to enable them to understand the provisions of working plans, and intelligently to carry out the orders of their divisional officers. For the training of candidates for this service, an Imperial Forest School was founded in 1878 at Dehra Dun, in the North-Western Provinces, and is attended by natives from all parts of India. The director of the school is also Conservator of a circle comprising three divisions, situated partly in the hills and partly in the low ground at their base. In these forests the students receive practical training for eight months of the year, while for the remaining four months they study forestry, mathematics, and some branches of natural science in the lecture hall. The instruction is given by the deputy director and three instructors, who together form the regular teaching staff, and also by the Superintendent of the Botanical Department of Northern India, the Superintendent of Forest Surveys, the assistant agricultural chemist, and native assistants. The school is accommodated in suitable buildings, which include quarters for the students, and is well equipped with museum, library, and gardens. The course of instruction extends over two years; it is for the most part

given in the English language, but a small number of men, who form a lower class, are taught in Hindustani. The total number of certificates given to the end of the current year was 418.

The Provincial Service consists of extra deputy and assistant Conservators, promoted from the subordinate class as a reward for good service, and usually employed in charge of the less important forest divisions. This service is not yet fully organised.

The Protective Service is composed of Forest Guards, whose duty it is to patrol the forests, to see that right-holders and permit-holders do not remove more than they are entitled to, to prevent cattle-trespass in the closed blocks, and generally to protect their charges, and see that the laws and regulations are not infringed. They are not professionally trained for these duties, but are required to be of strong constitution and active habits, and to be honest and intelligent.

The want of handbooks for the use of Indian forest officers was early felt, and considerable progress has been made in providing them. Among the more important of the works now available may be mentioned Brandis' *Forest Flora of North-Western and Central India*, Gamble's *Manual of Indian Timbers*, Baden-Powell's *Land Revenue Systems and Land Tenures of British India*, and his *Manual of Jurisprudence for Forest Officers*, Schlich's *Manual of Forestry* and the *Departmental Code*. Several important French and German works on sylviculture, protection, and utilisation have been translated by forest officers; and the inspection reports of successive Inspectors-General of forests, which are printed and circulated, form a series of papers on forest administration in the various provinces, the value of which cannot be too highly estimated.

In 1875 Mr. Baden-Powell and Dr. Schlich issued the first number of the *Indian Forester*, which was commenced as a quarterly magazine, but is now issued monthly, and forms a useful medium for the interchange of ideas, and for the record of interesting observations and experiments. It has rendered material aid in building up a system of scientific forestry suitable to the varied conditions and requirements of the country.

The object of State forest conservancy in India is to promote the prosperity of her people. Under the system now in force, the Government has secured to them a permanent and increasing supply of wood and other forest produce, including cattle-fodder, for which extensive reserves are specially maintained; and they benefit also by the regulation of the water-supply for irrigation, by diminished inundation and silting up of rivers, as well as in other indirect ways. What has been accomplished was far beyond the scope of private enterprise, and the needful measures could not have been taken otherwise than by the Government. The State has taken the initiative within the territory under its own administration, and the example thus set has been followed by the native rulers, forest preservation and management in several of the larger native States having now been organised on the same lines as in the British provinces. In Kashmir, under a British forest officer, and in Mysore, good progress has been made in the selection and settlement of State reserves and their permanent demarcation; similar work on a smaller

scale has been done in Jeypur, while in many other States forest administration is fairly well organised.

Much has been done, and much more remains to be done; but forest conservancy in India now rests on a sound and firm basis, and has reached a stage at which its steady progress cannot be arrested.

THE REPORT OF THE UNITED STATES COMMISSION ON THE BRITISH GUIANA FRONTIER DISPUTE.

By Ralph Richardson, F.R.S.E., F.S.A. Scot., Hon. Secy. R.S.G.S.

One set of political events so rapidly displaces another, that even important questions are apt to be forgotten. It may be necessary therefore to recall in a few words the circumstances which, in December 1895, provoked such irritation between the United Kingdom and the United States of America, concerning a dispute regarding the precise boundary-line between Venezuela and British Guiana. The Governments of Great Britain and Venezuela had quarrelled over this boundary-line for half a century, and the dispute remained as far from settlement as ever. A desultory war of outposts had been kept up for years in the Debateable Land between British Guiana and Venezuela. At last, in December 1895, the United States intervened, and President Cleveland sent to Congress Lord Salisbury's despatches in reply to the proposal of the United States that the boundary dispute should be submitted to arbitration. This unexpected intervention of the United States was based on what is known as the "Monroe doctrine," according to which American jurists maintain that it is the right and duty of the United States to interfere in any attempt by a European power to acquire fresh territory in the Continents of North or South America.

It may be premised that the dispute under notice was by no means so trivial as it pleased some to imagine. If the claim of the British Government was good, then not merely did valuable and extensive gold-fields become subject to British sovereignty,[1] but the best entrance to the river Orinoco, one of the great highways of South America, remained wholly under British sway.[2] Remembering the enormous tract of fertile, yet undeveloped, territory through which the Orinoco flowed, and its vast possibilities to British commerce, the possession by Great Britain of the best entrance to the Orinoco was evidently a subject of

[1] A special article in the *Times* of 27th August 1897, insists on the vital importance of these gold-fields to British Guiana and to the West Indies generally. The development of the gold industry, it declares, "means everything to British Guiana—whether it is to remain a vast wilderness of bush with a partially cultivated littoral, or is to become a wealthy, flourishing, and well-populated province of the Empire."

[2] Mr. T. H. Gignilliat, U.S. War Department, states that "the best entrance to the Orinoco" is by the Waini river and Mora Passage to the Barima (*i.e.* through territory claimed by Britain), the other mouths being shallow and obstructed by sand bars.—*National Geographic Magazine*, Washington, February 1896.

the greatest interest and value. If, on the other hand, the contention of the Venezuelan Government was valid, not merely would Great Britain forfeit the gold-fields and the Orinoco, but the Venezuelan frontier would be advanced to the river Essequibo, thereby reducing the colony of British Guiana to the phantom of its former self. Against the excessive claims of Venezuela the British Government struggled manfully for half a century. Against what it considered the excessive claims of Great Britain Venezuela appealed to the United States; and the intervention of the latter suddenly elevated the question to one of supreme international importance.

In his Message to Congress on 17th December 1895, President Cleveland stated that the Venezuelan dispute had reached such a stage as to make it incumbent upon the United States to take measures to determine with sufficient certainty what is the true divisional line between the Republic of Venezuela and British Guiana, and suggested that a Commission be appointed by the Executive for this purpose. President Cleveland's Message was enthusiastically received by Congress, and a Commission was accordingly appointed. After an elaborate investigation, this Commission has now issued from the Washington Government Printing-office, its Report in three volumes, and also an Atlas of "Maps of the Orinoco-Essequibo Region, South America."

The *first* volume of the Commission's Report consists of an able preface signed by all the members of the Commission, viz., Hon. David J. Brewer (President), R. H. Alvey, F. R. Coudert, Daniel C. Gilman, and Andrew D. White. This preface is dated 27th February 1897, and explains the extraordinary care taken by the Commission in the collection and examination of documents having a bearing on the dispute. At the same time, as their preface shows, the work of the Commissioners was brought to an abrupt, if also necessary, conclusion in consequence of the treaty signed at Washington on 2nd February 1897, which will afterwards be referred to.

The first (or Historical) volume of the Report likewise includes (1) Report on the Spanish and Dutch settlements prior to 1648, by Prof. John Franklin Jameson, Professor of History at Brown University; (2) Report as to the meaning of Articles V. and VI. of the Treaty of Münster, by Professor George Lincoln Burr, Professor of History at Cornell University, who also contributes (3) Report as to the territorial rights of the Dutch West India Company; and (4) Report on the evidence of Dutch Archives as to European occupation and claims in Western Guiana.

The *second* volume of the Commission's Report consists of (1) Extracts from Dutch Archives; and (2) Miscellaneous Manuscript Documents filed with the Commission by the Government of Venezuela. Professor Burr, who compiled in Europe the Dutch transcripts for the Commission, admits that his transcripts must be studied side by side with the large body of extracts from Dutch sources given in the Blue-book published by the British Government, known officially as "Venezuela No. 3 (1896)."

The *third* volume of the Commission's Report consists of the following interesting Geographical papers:—

1. Report upon the Cartographical Testimony of Geographers. By Severo Mallet-Prevost, Secy. of the Commission.

2. Report on the Maps of the Orinoco-Essequibo Region. By Justin Winsor, Librarian of Harvard College.

3. Report upon Maps from Official Sources. By George Lincoln Burr.

4. On the Historical Maps. By George Lincoln Burr.

5. Notes on the Geography of the Orinoco-Essequibo Region. By Marcus Baker, of the U.S. Geological Survey.

6. Partial List of Maps of the Orinoco-Essequibo Region, with Notes. By Marcus Baker.

The Atlas illustrative of the Commission's Report is extremely instructive, and contains seventy-six beautifully drawn maps, of which fifteen are new and made specially for it, while the remaining sixty-one are facsimile reproductions of old maps. Of these facsimiles forty-eight are reproductions of maps previously published, while the remaining thirteen are made from manuscripts.

In addition to the Atlas, however, we find, in vol. 3, what Mr. Marcus Baker modestly styles a "Partial List of Maps of the Orinoco-Essequibo Region," being a most carefully compiled catalogue of 489 maps, which he considers "while far from exhaustive, is quite full enough to make clear the map history of the boundary question." This List of Maps extends from the year 1511 to 1896, and of itself will remain a lasting memorial of the excellent service to Geography rendered by this Commission.

In their valuable contributions to vol. 3, several of the authors discuss the question whether the Amacura, the Barima, or the Pomeroon river forms, from cartological evidence, the true northern divisional line. Regarding this important point a very distinguished witness is Sir Robert H. Schomburgk, to whom, says Mr. Marcus Baker, "more than to any other one man, are we indebted for our present knowledge of the geography (of the Orinoco-Essequibo Region); and the large map of it, which may be called *The Great Colonial Map*, published in London with the date 1875, based chiefly on Schomburgk's reconnaissances and explorations 1835–1844, remains the best we have to this day."

As the present writer showed in a paper read at the British Association's meeting at Liverpool on 21st September 1896, the familiar term "Schomburgk line" is not always easy to locate; but (with the exception of Dr. Emil Reich's renderings) the various Schomburgk lines have at least one thing in common, namely, they begin at the mouth of the river Amacura. Mr. Marcus Baker's well-deserved eulogium of Schomburgk is all the more magnanimous on his part, considering that the "Schomburgk line" was made the battle-cry of the British Government, and that that line was declared to represent the irreducible minimum of British claims.

Schomburgk was a Prussian whose scientific attainments attracted the attention of the Royal Geographical Society, which, in 1835, sent him out to explore the colony of British Guiana. His discovery there of the *Victoria regia* water-lily will alone perpetuate his name. Taking advantage of his presence in the colony, the British Government

intrusted him with the preparation of a sketch-survey of it, instructing him, by examining its physical features and by interrogating the Indians, to learn as precisely as possible what had been the recognised boundary-line between Spanish and Dutch Guiana, and consequently between Venezuela and British Guiana.

Schomburgk spent nine years (1835-44) on this Government survey, and whether we adopt the "Schomburgk line" shown on the map dated 1846 by Sir Robert, accompanying his brother Richard's *Reisen in Britisch Guiana in den Jahren* 1840-44, published at Leipzig in 1847; or whether we adopt the "Schomburgk line" laid down on a map by Schomburgk of 1841, given in the *British Government's Blue-book* of August 1896, we must recognise that, in Schomburgk's opinion, the river Amacura formed the northern part of the divisional line between British Guiana and Venezuela. As "Her Britannic Majesty's Commissioner for Surveying and Marking out the Boundaries of British Guiana," Schomburgk took formal possession of the territory adjoining the Orinoco from the Amacura eastwards, and dated his certificate from "Victoria Point, river Amacura, 13th May 1841" (*British Government's Blue-book*, August 1896, p. 9).

It is perhaps worth noticing, as a proof of very early occupation of the Orinoco by the English, that, having received letters-patent from Queen Elizabeth, an expedition under Sir Walter Raleigh, the father of English colonisation, sailed up the Orinoco in 1595. Raleigh informed the Indians that his Queen was an enemy to the Spaniards, had freed other nations from their oppression, and had now sent to rescue them. To confirm his statement, he gave each cacique (or chief) a coin, so that they could possess the Queen's likeness, and these were treasured and even worshipped for a century afterwards.[1] As Mr. Marcus Baker points out, the Amacura river was "so written by Raleigh in 1595." He takes no notice of the north-east promontory of its estuary, named "Victoria Point" in Schomburgk's Map of 1841.

When we leave the Amacura and pass southwards, the boundary-line becomes more difficult to follow. Schomburgk laid down at least two lines from the Amacura southwards. One takes in the whole basin of the Barima river, and this is the "Schomburgk line" championed by the British Government. The other "Schomburgk line" does not. The former line gives Great Britain the whole of the Barima gold-fields. The latter does not. The former gives Great Britain the whole southern bank of the Upper Cuyuni. The latter does not.

Fortunately, the difficulties concerning this boundary-line question have been overcome by the wise resolution of the British, American, and Venezuelan Governments (embodied in the treaty signed at Washington on 2nd February last), that prescriptive possession for fifty years shall be recognised as the test whether disputed territory belongs to British Guiana or to Venezuela. It is said that this is the first occasion on which prescriptive possession has been recognised in

[1] *The West Indies and the Spanish Main*. By James Rodway ("Story of the Nations" series, 1896).

international law. If it had been recognised earlier in the present dispute, it would have saved time, money, and much dangerous and unnecessary excitement.

Whilst therefore, owing to the sudden termination of its labours, in consequence of the Washington Treaty, we cannot ascertain what the United States Commission, on the evidence of treaties, documents, and maps, considered to be the "true divisional line between the Republic of Venezuela and British Guiana," the decision of the Commission has been rendered unnecessary by the resolution above mentioned of the Governments concerned, viz., "that fifty years adverse holding, whether by political control or actual settlement, should give a good title, while claims resting on other grounds, valid in international law, should also be recognised." To carry out the terms of this resolution an international tribunal was appointed to sit at Paris, and with it rests the settlement of the long-agitated question of the precise boundary-line between Venezuela and British Guiana.[1]

GEOGRAPHICAL EXCURSIONS FOR SCHOOL CHILDREN.

By T. R. Marr,

Secretary, Woolwich University Extension Society.

In the Dunfermline board schools, during the last three years, the experiment has been tried of introducing a series of excursions as part of the school work, and as these excursions have been specially associated with the historical and geographical work, they may have some interest for readers of this *Magazine*.[2] The places selected for the excursions were naturally all within easy reach of Dunfermline, and were in every case chosen because of their importance in history, or as being specially suitable for a geography lesson. Among the places visited were Stirling, Edinburgh, Linlithgow, Kirkcaldy, Burntisland. Each party consisted of about thirty children, a number which should never be exceeded, and if possible reduced to a dozen or fifteen. A whole day was given up to each excursion, the children usually leaving home about 9 A.M. and returning to Dunfermline about 5 P.M. Formerly the excursions were made on Saturdays only, but this year the School Board arranged that they might take place on week-days, attendance at an excursion to be counted as a school attendance. This is a step of great importance, as it places excursions on a proper footing, and makes them really part of the systematic school teaching. It also removes the great objection to Saturday excursions, that they destroy the teachers' holiday. Two or more teachers in each case went with the children, but during the day they

[1] The author is informed that no publication has yet been issued by this international tribunal, the president of which is Professor Maertens of St. Petersburg.

[2] A note on the first year's excursions will be found in *S.G.M.*, xi. p. 316.

were under the guidance of the writer, or in some cases in previous years of Mr. A. J. Herbertson or Mr. Stuart Thomson.

Arrangements were made for the children to have dinner in the middle of the day, the cost of which they paid themselves. The travelling expenses of the children and the cost of organising and conducting the excursions have been met by a special grant made to the Dunfermline Board by Mr. Henry Beveridge of Pitreavie; but it is noteworthy that the total expense per child for each excursion is only a little over a shilling, although Dunfermline is not favourably situated for obtaining very cheap railway tickets. It is evident, therefore, that school boards and managers do not need to deny their pupils this educational aid on the ground of expense. No accident of more than a trifling nature has happened during the three years—in spite of long railway and boat journeys and visits to rocky shores—which proves that with ordinary care there is little or no risk. It is true that in the majority of cases only children from the fifth standard upwards were taken, but similar excursions might easily be arranged for younger children.

The value of excursions of this kind lies mainly in the fact that they make concrete and real to the children what has often been abstract or a mere name. The function of the guide is mainly to draw attention to points likely to be missed, to suggest relations, and, most important of all, *to answer questions.* A visit to Stirling, for instance, helps to vivify the geography of Scotland, and explains many historic events. The "Central Plain," so well known by name, becomes real when seen from the ramparts of Stirling Castle; and the importance of Stirling as a stronghold in Scottish history is realised after visiting its impregnable rock, with its wide view of the plain and its nearness to the fordable part of the river, giving it command of the highlands. In such ways the geographic interest is called on to supplement and aid the historic one.

Much use is made of maps—real maps—in the open field, the children learning not only to identify places by reference to the map, but also to understand the various symbols usually employed in the different kinds of maps. The importance of such points as accurate orientation is insisted on, a pocket compass being freely used. The teacher, of course, should never go on an excursion without a compass, but he should also show how to locate the cardinal points by help of his watch, and should insist on his pupils using such instruments for themselves.

At Leith, or in the simpler cases of Kirkcaldy or Dysart, the elements of industrial and commercial geography can be illustrated. Imports and exports mean something when one has watched the loading or discharging of cargo; and similarly manufactures and industries become real things for a child who has had a glimpse of a great workshop or factory. So, too, the physical features and the occupations of the peoples of other lands become more intelligible as these same phenomena are better understood at home.

No teacher thinks nowadays of teaching botany or zoology without specimens, and, whenever possible, field work is done. How many teachers of geography, in our higher schools even, where the opportunities for the introduction of rational educational methods are as a rule so much more

frequent than in the board school, where the time-table is regulated by the code, think it necessary or even desirable to show their pupils an actual plain, or cape, or estuary, or valley, and the part these elements play in the landscape? Yet these and like things are of no less importance in the study of geography than plants and animals in that of biology. Here, then, is one opportunity for the improvement on simple and rational lines of our methods of teaching geography in schools, which well merits the attention not only of teachers but of all who are interested in promoting the real study of geography.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lectures in November.

As already announced, the Anniversary Lectures will be delivered by Mrs. Bishop, her subject being Western China. The meetings will be held on Nov. 9th in Edinburgh, the 10th in Glasgow, the 11th at Dundee, and the 12th at Aberdeen. The hour of meeting will be 8 P.M. in all cases. The Marquis of Lothian, President of the Society, will take the Chair in Edinburgh.

On Nov. 16th Mr. Alfred E. Pease, M.P., will lecture in Edinburgh on Somaliland.

The Annual Business Meeting.

This meeting will be held in the Society's Hall, Edinburgh, at 3 P.M. on November 17th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

The Indian Earthquake.—The Geological Survey of India has collected a large number of data on the earthquake which occurred in India on June 12th, at 5 P.M. This material cannot be thoroughly digested for some time, but a short note by Mr. R. D. Oldham is published in the *Records of the Geological Survey*, vol. xxx. part 3.

The area over which the earthquake was felt is enormous, extending from the farthest extremity of Assam, and from Akyab in Burma, to Masulipatam in Madras and Ellichpur in Berar, and westward to Surat, Ajmere, and Simla. At Gnatong, on the frontier of Sikkim and Tibet, the shock was strong enough to throw down some barrack chimneys, and it is said to have been felt at Lhasa. The range of the shock was over 24 degrees of longitude and 16 of latitude, or an area of about 1,275,000 square miles. The area over which the shock was destructive is also great. From Darjiling, Monghyr, and Calcutta on the west to Jorhat damage was caused to buildings, the destructive force attaining its maximum in Shillong, Cherrapunji, and Tura. In Shillong hardly one stone was left upon another.

In 1882 a seismometer, composed of a series of cylinders of various diameters, was set up at Shillong. These indicate that the violence of the shock was at

least equal to a backward and forward shake of seven inches repeated sixty times a minute. Few buildings could withstand so great a disturbance, and even the boundary pillars were shaken to pieces. The rate of transmission was very high. The time the wave took to travel from its origin to the farthest point at which it was perceptible was only eight minutes. A few time-observations taken at random from the collection indicate a rate of transmission of about 10,000 feet per second, or over 112 miles per minute. At Bombay the instruments in the magnetic observatory were disturbed six minutes after the shock was felt at Calcutta, and about nine minutes after the probable time of its commencement somewhere below the Garo or Khasia hills. Mr. Heath observed two sets of tremors at the observatory on Blackford Hill, which, if both due to the Indian earthquake, must have travelled from the centre of origin to Edinburgh, the one in 14 minutes, the other in 1 hour 28 minutes.

Northern Burma.—Prince Henry of Orleans passed close to the sources of the Irrawadi and practically solved the question of its origin, but there still remains a large extent of little-known country between these sources and the junction of the N'maika (or Nam Kha) and the Malika. The latter river has not been explored till this year, when, in February, Lieutenant Eldred Pottinger surveyed it, and then, passing through the Kachin country, tried to make his way eastward to the Upper Salwin. In 26° 45′ N. lat. he reached the last large affluent of the Nam Kha in the country of the Maru, a tribe of Kachins whose dark colour is due to an incrustation of dirt. An attack of the Maru, which caused the death of several of his men, prevented Mr. Pottinger from advancing northwards so as to connect his survey with that of the Prince of Orleans. He had to make a hasty retreat to the Chinese frontier, whence he returned to Burma, reaching Myitkyina in June.

Trade-Routes in North-Western Persia.—The shortest route connecting Teheran with foreign countries runs almost due north to the small port of Meshed-i-Ser on the Caspian sea. Its length is about 150 miles. Caravans pass along this road somewhat frequently in summer; in winter travelling is stopped by the snow. But the chief route to the Caspian passes through Kazvin to Enzeli at the south-western corner of the sea, 300 miles distant, where Russian mail steamers call every week in summer and every fortnight in winter. As far as Kazvin, ninety miles from Teheran, the carriage road is in good order, but thence over the Kharzan pass there is only a wretched bridle-path. The next section, to Resht, is again practicable for vehicles, and from this place to Enzeli the connection is maintained by boats on the lagoon. Whether the whole route will be put in good condition by the Russians is doubtful, as the Shah has refused the prolongation of the concession. A third route to the Caspian ending at Astrabad is now little used. The difficulties of the ground are less than on other routes, and there is good anchorage in the harbour of Astrabad, so that this road, though longer, may become of importance.

The road through Kazvin and Tauris to Tiflis is practicable for carriages throughout its entire length of 708 miles, though the transport is carried on, as everywhere else in Persia, with baggage animals. At Tauris a road branches off to Trebizond, 1100 miles from Teheran.

In the west Baghdad is the harbour for foreign trade. Its distance from the capital is 520 miles. Between Baghdad and Basrah there is considerable traffic. South-westwards runs a caravan road to Shushter through Isfahan. From Teheran the distance is about 465 miles. Steamers run from Shushter along the Karun to the seaport Mohammerah, but an interruption caused by rapids occurs

at Ahwaz. There remains to be noticed the road through Isfahan and Shiraz to Bushire, 922 miles. As far as Shiraz the journey can be made on wheels, but beyond there is only a wretched bridle-path which camels cannot traverse.

The duration of the journey is on the average three weeks to the Caspian ports, to Trebizond three to three and a half months, to Baghdad thirty-five to forty-five days, and to Bushire two to two and a half months. The freightage averages £10 a ton to the Caspian, to Trebizond £20 for bales and £26 for chests. To Baghdad it is £14, and to Bushire £14 to £15.

The routes to Tiflis and to the Caspian are of no importance, except for Russian commerce, as there is no free transit for goods through Russian territory. The Shushter route, owing to the transhipping at Ahwaz and Mohammerah, has not answered the expectations formed of it. There remain, then, the routes to Trebizond, Baghdad, and Bushire. The Baghdad is the shortest land route, but the Bushire route has the advantage of cheapness, and of avoiding the vexations of the Turkish Customs and transhipping. From Trebizond, again, the sea voyage is shorter, and the camels employed on this route can convey bulkier and more fragile goods. Also a large part of the European trade with Persia is in the hands of firms established at Constantinople.—*Aus Allen Weltteilen*, Heft 21.

The Pamirs.—Lieut. O. Oluffsen led a Danish expedition to the Pamirs in 1896. This elevated region lies from 8800 to 13,000 feet above sea-level. The mountain ranges, running from north-east to south-west, rise, as a rule, only 2000 to 3000 feet above the valleys; but in Darwaz, in the Kashgarian range, and in the bends of the Pamir river, they attain from 6900 to 8200 above the plateau, so that absolute heights of 21,000 to 22,000 feet occur. The natives of the Pamir apply the term only to the eastern part, while the western highlands are divided into Wakhan, Shighnan, Roshan, Darwaz, etc. The Pamir proper has also several divisions—the Trans-Alai range on the northern border, the Khargosh Pamir by the Great Kara-kul, the Rang-kul Pamir, the Sary-kol and Taghdumbash in the east, the Alichur Pamir, north of the Yeshil-kul, and the Great and Little Pamirs.

The word Pamir denotes a high waste region exposed to the wind (other authorities give different interpretations). That it is high and exposed to the wind is quite true, but the epithet waste applies only to the eastern, or rather to the central, portion. The glaciers and enormous masses of snow which fall in the winter and melt in the summer months give birth to a number of streams that, cutting deep into the plateau as they flow westward, produce the conditions necessary for the growth of vegetation and for cultivation. The rivers have a rapid current of $6\frac{1}{2}$ to 30 feet a second. In their upper courses their beds are broad and stony, usually without vegetation; farther down they flow in deep, narrow valleys, through which they pour over huge blocks of rock and form foaming cataracts. Towards the east the vegetation is so scanty and the summer so short (June, July, and August) that permanent settlement is quite impossible; Kirghiz wander with their herds about the lakes and streams to make the most of the summer herbage. Alai is said to mean "Paradise" in their language, and this steppe yields particularly nourishing fodder to their herds. The Alichur Kirghiz are much wealthier than the Kara Kirghiz, often possessing cattle to the value of £2000. In the southern and western districts, in the deep valleys and wild, romantic defiles lives an agricultural population, chiefly Iranian. Artificial irrigation is necessary, yet the fields extend far up the slopes. Unfortunately these provinces have suffered for many years from the incursions of bands of Afghan robbers, and many villages, in Gharan, for instance, are now deserted.

Lieut. Oluffsen travelled from Osh over the Taka pass (7298 feet) and the

Taldyk (12,000 feet). The Russians have constructed a good road, which winds even up the Taldyk pass so gradually that it is practicable for vehicles. In June the Kirghiz were already settled in the ravines, and their cattle and flocks, horses and sheep, were scattered over the mountains; patches of oats and barley were sown as far as 6200 feet up the slopes. Large caravans of camels pass along this road to Kashgar. After a stay of two days on the Alai steppe, with heavy rain and the thermometer never above 50° F., Lieut. Oluffsen crossed the Kizil-art pass to the Kara-kul. Here the climate was very different; the relative humidity was frequently only six to eight per cent., and the sky almost always cloudless. The wind was very strong in the day, and the day temperature in June and July was seldom more than 61°, while there were almost always frosts at night. The Kara-kul and Yeshil-kul, surrounded by snowy mountains, present a picturesque aspect. The Kara-kul has no exit, and is surrounded with stretches of salt-covered land; only a few ducks were seen about it. The Yeshil-kul, on the other hand, teems with life. Ducks, geese, gulls, and woodcock frequent the marshy meadows around the yellow lake, and the water is rich in fish of various species. Black bears were seen, and *Ovis Poli* and the Kizik, a smaller kind of wild sheep, are numerous.

From Yeshil-kul the traveller crossed the Khargosh pass to the Pamir-daria and thence into Wakhan. On arriving at the Panja river, he came again to permanent settlements. The Panja is often fully thirty yards broad; its current is rapid, and its water black and dirty. Much of the land is fruitful, and in the side valleys large fields are irrigated and cultivated. Besides barley, wheat, and millet, apricots are important, being, when dried, eaten as bread. In Gharan, as well as in Wakhan, there are hot springs (108° and 113° F.), and in Shighnan, Roshan, and Darwaz garnets glitter in the rock. These provinces are very fertile, and vines, peaches, apricots, pears, apples, and pomegranates thrive remarkably; the cereals grown are wheat, barley, and millet, and cotton and various vegetables are also to be seen. The inhabitants are the well-known Galchas, a people of fine physique; in religion they are Shiites. Lieut. Oluffsen witnessed no religious ceremonies, but he believes that fire-worshippers still exist in Wakhan and Gharan, for he saw on the rocks the small clay jugs used in their rites.

The climate in these western districts of the Pamir is very pleasant in summer. Temperatures of 68° to 80° were observed, and the nights were as warm as the days. —*Verh. der Gesell. für Erdkunde zu Berlin*, No. 6.

AFRICA.

The Population of Egypt.—The census taken on June 1st shows that the settled population of the country is 9,385,235, while in 1882 it was only 6,533,261. The semi-nomad population, including the Beduins, has risen to 172,696. There is a decrease in the number of nomads, which is now 96,302, against 98,196 in the former year. The total population of Egypt is, then, 9,654,323, with an increase of 2,872,283, or 42 per cent. These results are subject to slight corrections, but the total may be given in round numbers as 9,700,000. The 13,410 inhabitants of Suakin are not included, nor those of the province of Dongola, which were also omitted from the previous census. The towns of Damietta and Rosetta alone have diminished; all the others show an increase of population. The largest are as follows:—Cairo, 576,400 inhabitants; Alexandria, 319,700; Tantah, 57,300; Asyût, 42,100; Mansurah, 36,300; Zagazig, 35,500; Port Said, 35,000; Damankur, 32,000; Damietta, 31,200.—*Boll. della Soc. Geogr. Italiana*, vol. x. Fasc. 9.

The Bottego Expedition.—The narrative of the journey of this expedition, which terminated so disastrously, is recounted by two of the survivors, the naval lieutenant, L. Vanutelli, and Lieutenant C. Citerni, in the *Boll. della Soc. Geogr. Italiana*, vol. x. Fasc. 9. Starting from Brava on October 1st, 1895, the caravan skirted the coast for three days and then marched inland to Comia on the Webi Shebeli. After passing the stream and journeying somewhat farther to the north, the travellers were hospitably received by Somali of the Dabarre tribe, and were warned of the hostile disposition of the Rahanuin. Nevertheless they resolved to visit the country and to ascertain if the reports of its fertility were true. For ten days they marched through lands cultivated with durrah, cotton, beans, tobacco, etc., and amply irrigated by water collected in cisterns. The population is fairly dense, and numerous villages are scattered over the district. The hostility of the natives had not been exaggerated, and Dr. Sacchi was treacherously wounded with a lance.

On November 18th Lugh was reached, where a halt of forty days was made to construct a fort. Then the march was resumed along the river Ganana (Jub) and its tributary, the Daua. At Jubichio the river bank was left for the route to the Boran territory and the lakes. The caravan road was in excellent condition, and at many points huge circular pits were hollowed out of the rock for storing water. Some of them had a depth of about 300 feet, with a diameter at the top of some 230 feet; an inclined path excavated in the wall afforded an easy descent to the water. They are said to have been constructed long ago by the Wardai, a people that has completely disappeared. The Boran inhabit the vast territory extending from the neighbourhood of the Jub up to Lake Stephanie. They are occupied solely in grazing, and, unfortunately, their herds are a great temptation to their neighbours. The Borani themselves are gentle and peaceful, well disposed towards white men, favourably inclined to trade and travellers, so that their country can be traversed with great security.

Passing through Ashebo the expedition came to Burgi, near the source of an affluent entering the Sagan on the left bank, and situated in lat. 5° 23′ N. and long. about 38° 15′ E. Here Prince Eugenio Ruspoli was buried. While the expedition sojourned in this fine, well-cultivated country, Vanutelli and Citerni went down to the Sagan to explore its course. This river, held by Ruspoli to be the Omo, lies far to the east of the latter, and originates in the Delo mountain. It flows, as Donaldson Smith has shown, into Lake Stephanie, though he gives it the name of Galana Amara. On May 1st the march was recommenced, the party making for a chain of mountains rising abruptly between the valleys of the Sagan and Galana, the latter flowing down the eastern slope and turning northwards to the Lake Pagade. The range culminates in Mt. Delo at a height of 11,800 feet. All the flanks are cultivated and densely inhabited. In passing through the country the expedition had repeatedly to have recourse to their arms. At length they arrived at the shore of the beautiful Lake Pagade, extending from 5° 59′ to 6° 37′ N. lat., and about ninety miles in length. It is identical with the Abbala or Abba, of which some vague reports have been received; Vanutelli and Citerni have proposed the name of Margherita in honour of the Queen of Italy. On the south it communicates by means of a short channel with the Lake Chamo (lat. 5° 43′ to 5° 57′), the Bissan Abbaya of Ruspoli. Abbaya, in the language of the natives, means merely a large sheet of water. The Abbala contains twelve islands, all, like the banks, cultivated and inhabited by hostile Aruro. The eastern side is still more thickly peopled, and the crops still more luxuriant, for the mountains, which attain an altitude of over 13,000 feet, abound in water.

Having crossed the chains of Alfa and Gofa, and passed the impetuous Maze,

an affluent of the Omo, the expedition reached the main river on July 1st, 1896, in lat. 6° 40′ N., and descended its valley to Lake Rudolf in 4° 47′ N. From this point Captain Bottego and Lieutenant Vanutelli made an excursion to Lake Stephanie and ascended the Sagan, and Dr. Sacchi led a party along the western shore of Lake Rudolf, crossing the Omo at a point somewhat to the north of the lake, where it has a breadth of 220 yards, and a maximum depth of 13 feet. This party marched as far south as the mouth of the Tirguell, reached by Teleki and Von Höhnel from the south. The authors depict the course of the Omo as running in a south-westerly direction to Lake Rudolf as Borelli and Von Höhnel's observations indicate, whereas Dr. Donaldson Smith, who ascended it for seventy geographical miles, states that it runs nearly due north. The same traveller also asserts that there is no river Bass reported by Teleki and Höhnel as entering the northern end of the lake. Perhaps the discrepancy is explained by the discovery of a stream which loses itself in a swamp not far from the north-west corner of the lake, and drains into it by infiltration. The mouth may have been silted up since the time of the Austrian travellers.

Ascending this stream the expedition came to the mountains of Kaffa, fertile and yielding large quantities of coffee. Here they crossed into a large valley watered by a stream flowing towards the Nile, which the natives call the Juba. This they followed as far north as 7° 40′, where it bears the name of Acobo, and then marched northwards to the Upeno, the largest of the headwaters of the Sobat; it is 320 yards broad in the dry season, and carries about 20 inches of water. Passing through Sayo the expedition came to Lega, where it met with its disastrous termination.

Physiography of the Nyasa-Tanganyika Region.—Mr. J. E. S. Moore contributes an interesting article on the Physiographical Features of the Nyasa-Tanganyika Region to the September number of the *Geographical Journal*. The paper is illustrated by a geological map, which differs somewhat round the southern end of Lake Tanganyika from that of the late Joseph Thomson. Mr. Moore shows the high interior plateau as a vast area of sandstone of an almost uniform height of 4000 to 4500 feet, dipping very slightly to the west. This sandstone plateau extends far up Lake Tanganyika, and also forms the great plains to the west of the lake, gradually sloping from a 4500 feet level to 3500 feet, which is approximately the height of Lake Bangweolo, where the water gathers in the south-west to a depth of only 10 to 12 feet. This sandstone is also found round Lake Rukwa. It approaches, but does not meet, the northern shores of Lake Nyasa, and it curves round the Nyika Plateau and towers above the Lake at Mount Waller. It is continued on the other side of Lake Nyasa, and a band of it is seen running eastwards from Amelia Bay.

"This vast area of sandstone is pierced in all directions by high upstanding masses of gneiss and granite rocks, which rise as mountain chains above the general level of the sandstone plains, like islands above an ancient sea, and as the sandstone formations rest approximately in their natural position upon these upthrust igneous rocks, it is by no means impossible that this is what they really are." The gneiss and granite form the mountain range between Lake Tanganyika and Nyasa west of Lake Rukwa, as well as the Nyika Plateau, the Livingstone Range, and all the rest of the rocks round the Lake Nyasa, whose shores, however, are bordered by alluvia deposits, which are continuous with those round Lake Shirwa, and also extend down the Shiré valley almost to the Murchison Falls.

The sandstone round the southern arm of Lake Tanganyika rises in cliffs 2000 feet above the lake in the west, while the land slopes very gradually upwards from the

eastern shore. A succession of great faults running north and south in the sandstone and conglomerate is found, and in their hollows lies the lake, which cannot be older than these valleys. A gigantic fault is to be traced in Lake Nyasa, where the imposing sandstone cliffs of Mount Waller face the sandstones east of Amelia Bay. There is no evidence as to the date of these faults, but farther north they have been shown by Dr. Gregory to be comparatively recent. In the north of the Nyasa there are evidences of local earth movements still going on. Limestones with fossils of species which exist in the lake at the present day occur near Deep Bay, so the lake must be of greater age than these rocks.

In the southern part of Lake Nyasa, Mr. Moore saw no evidences of great faults or rift valleys. "Here the country is composed of more or less lofty granitic masses, the axes of which run approximately north and south, but which divaricate from one another, and enclose wide areas of land, which are now filled with modern alluvium." These alluvial flats are "approximately of the same height . . . and show abundant evidence of having been covered at one time, or a succession of times, with water," and fossils of forms now living in Lakes Nyasa and Shirwa are common.

Mr. Moore thinks that what evidence there is points to Nyasa being older than Tanganyika as a lake.

AMERICA.

Climate of Davis Bay and Baffin Bay.—Mr. Ralph S. Tarr discusses, in the *American Journal of Science*, certain marked differences of climate on the two sides of the sea separating Greenland from America. The climatic conditions of Baffin Land and Labrador are, he says, wonderfully near those which produce glaciation, and, if the upheaval now in progress continues, glaciers will appear at no very distant time in the valleys of Labrador, while those of Baffin Land will increase in extent. Thus a great step would be taken towards the formation of a general ice-sheet. On the Greenland side the land is evidently subsiding, and the front of the Greenland glacier retreating, these changes being particularly evident in the Upper Nugsuak peninsula. Mr. Tarr's suggestion that the balancing action of the weight of the ice may produce elevation or depression is interesting, and indicates a line for future investigation.

"Davis Bay" is proposed as the name of the sea between the Atlantic Ocean and Davis Strait.—*Geogr. Journal*, October.

The Waters round the Newfoundland Banks.—Dr. Gerhard Schott, of the Deutsche Seewarte, discusses the observations of German and Dutch seamen on the waters of the Atlantic between 40° and 50° N., and between the American coast and 40° W., in *Petermanns Mitteilungen* (ix., 1897). The paper is illustrated by maps showing the surface temperatures, the northern, mean, and southern limits of the region where the Gulf Stream and cold currents meet, and the distribution of fogginess, both for February and August, the surface currents for the latter month, the mean limit of drift ice, and the general steamship routes during the ice and iceless halves of the year.

From these data Dr. Schott shows that the waters both of the Gulf Stream and of the Labrador Current flow only over the deeper regions, and do not spread over the Newfoundland Banks. The speed of the Gulf Stream is not great east of 60° W., and the stream practically ceases to exist as a current east of 40° N., although its influence on the temperature of the surface waters reaches much farther east. The Labrador Current can be traced off the eastern edge of the Newfoundland Banks, where it flows first south-easterly, and then to the south and south-south-west, and

ends in the Gulf Stream east of 50° W. A cold water "gulf" is formed by the isobars over the southern extremity of the banks.

How is the New England "cold wall" formed? In the first place, the cold region west of the "wall" is not really cold, but of quite normal temperature for the latitude; only it seems cold when compared with the warm waters of the Gulf Stream to the east. The Cabot Stream from the Gulf of St. Lawrence brings water to this relatively colder region as far south as Cape Hatteras; and south of that Cape the "cold wall" is caused by a back current of the Gulf Stream itself. The frozen area in the Gulf of St. Lawrence is, however, a source of cold in winter.

The seasons do not bring about any regular change in the position of the axis of greatest speed of the Gulf Stream, and only slight changes in its lateral extension. The maps show that the mean line between warm and cold currents is a little farther south in winter than in summer, but the variations in this region are both very considerable and frequent. Dr. John Murray of the *Challenger* showed this most graphically at the last meeting of the Scottish Meteorological Society, when he discussed the variations in the surface temperature of the whole ocean. It is worth while noticing that this region is one traversed by most of the centres of low pressure as they travel eastwards, and therefore wind changes are constantly occurring. The explanation of these variations in surface temperature, or in other words the predominance of warm Gulf Stream water or of colder water from the Cabot Strait, is to be sought in the winds; and it will be an admirable though arduous research to work up all the data available, both oceanographical and meteorological, and not merely those obtained by the ships of two nations.

The surface temperatures vary much more in winter than in summer. This is partly to be explained by the greater frequency and strength of winter storms, and partly by the steeper gradients of winter temperature south of Cabot Strait, between 40° and 45°, the temperature differences between these two latitudes being nearly 18° C. (32° F.) in winter, compared with about 10° C. (18° F.) in summer. Farther east, where the Labrador Current meets the Gulf Stream, this variability of temperature is not nearly so great. In this region, however, fog is more frequent than anywhere else, save close to the American shore from a little north of Halifax to beyond Sandy Hook. Icebergs are an additional danger over and east of the Newfoundland Banks, where the fog is commonest. The larger icebergs float only in the deep water, but the smaller ones are able to make their way over the Banks.

The maps clearly show that it would be better if the southerly courses adopted by steamers during the ice period were not changed in the middle of July, but kept at least until the end of August so as to avoid passing through the regions of greatest fog, as the present courses do. The course to St. John's, Newfoundland, is comparatively free from fog, but in early summer ice is common. These are important considerations in the matter of making St. John's the terminus of a quick Atlantic service.

British Honduras.—By the treaty with Mexico, which, though signed in 1893, was ratified only on July 21st of this year, the boundary of British Honduras is fixed as follows:—"Beginning at Boca Bacalar Chica, the strait which separates the State of Yucatan from Ambergris Cay and its dependent isles, the boundary line runs in the centre of the channel between the above-mentioned cay and the mainland, south-westward as far as the parallel of 18° 9′ N., and then north-west midway between two cays as far as the parallel of 18° 10′ N.; then, turning to the westward, continues across the adjoining bay, first westward to the meridian of 88° 2′ W., then north to the parallel of 18° 25′ N., again westward to the meridian

of 88° 18′ W., and northward along that meridian to 18° 28½′ N. lat., in which is situated the mouth of the river Hondo, which it follows in its deepest channel, passing west of Albion Island, continuing up Blue Creek until the said creek crosses the meridian of Garbutt's Falls at a point due north of the point where the boundary lines of Mexico, Guatemala, and British Honduras intersect; and from that point it runs due south to lat. 17° 49′ N., the boundary line between the republics of Mexico and Guatemala, leaving to the north, in Mexican territory, the so-called river Snosha, or Xnohha."

South-Western Patagonia.—On p. 95 the journey of Señor Siewert up the Santa Cruz valley and to Mount Payne was described. More recently Dr. Otto Nordenskiöld has visited the same district, an account of which, with a map, is published in the *Geographical Journal* for October. He advanced westwards as far as 73° 10′ W. long., where, in lat. 50° 50′ S., he discovered a large mountain lake surrounded by mountains upward of 6000 feet high, with numerous icebergs from a glacier at its upper end floating on its surface. This lake he proposes to name after Baron Dickson, who provided the greater part of the funds for the expedition. Its outlet, which Dr. Nordenskiöld calls the Payne, flows, seven miles to the east, into another lake, and then turns southwards to traverse other and larger lakes. North of these two lakes, and some distance to the east, stretch the Baguales mountains, while on the south rises the wild and curious Mount Payne, covered in many parts with ice and snow. One of the most important of the lakes drained by the Payne river is the Sarmiento; it consists of two parts, an open basin covering an area of about twenty-six square miles, and to the west a narrow channel with walls bearing traces of ice action—a typical fiord of the age when the Atlantic extended almost to the eastern slope of the cordilleras. On the south the lake skirts a mountain 3500 feet high, which is a good example of the type found in the transition zone between the cordillera and pampa. Slate, probably Mesozoic, highly contorted, forms its base, while higher up are seen Tertiary rocks, with only a slight dip. The mountains generally have rounded, weathered forms, except where volcanic rocks occur, as in the Baguales, where the soft Tertiary rocks are protected by an immense sheet of basalt eroded into most singular outlines. The Viscachas, which flows within a few miles of the source of the Coyle, the Payne, and the other large rivers of the district, all converge to the Maravilla lake, a sheet, perhaps, seventy square miles in area, lying to the south of Sarmiento. This, no doubt, sends its waters to the sea through a large river opening into the head of Last Hope Inlet.

The high snow-covered cordillera, consisting of folded metamorphic schists, presents a striking contrast to the dry pampa land of Tertiary or recent age, situated only fifty miles distant. Between the two lies a broad zone of transition, with mountains almost as high as the higher peaks of the cordilleras, and formed partly of younger contorted slates, partly of horizontal or slightly inclined Tertiary rocks, eruptive or sedimentary. Probably the isolated mountains were at one time joined to the central cordillera, and rivers flowing to the east cut out valleys which were considerably widened by great glaciers.

MISCELLANEOUS.

The Austrian man-of-war, *Pola*, was to set out for the **Red Sea** on Sept. 1st, where the scientific investigation of the basin will be continued.

An important railway has lately been opened in the **United States** running from Kansas City through Pittsburg, Mena, and Shreveport, and then south-west to Beaumont and south-east to Port Arthur. A branch runs off to Lake Charles.

It is reported that **Mr. Walter Wellman** intends to make another Arctic journey next summer. He proposes to sail from Bergen in June, and after forming a depôt of provisions at Cape Flora, march northwards to Cape Fligely, whence he will start in 1899 towards the Pole.

Herr C. Theodor Stöpel has ascended **Orizaba**, Mexico, and determined its height by means of three aneroid barometers. The results are :—the peak of Orizaba, 18,333 feet ; the southern peak above the crater, 17,841 feet.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xl. Nos. 8 and 9.

The new volume (the twentieth) of the *Transactions* of the Gaelic Society of Inverness contains further contributions to the knowledge of **place-names**. Mr. John Mackay writes on the subject with which he is familiar, the place-names of Sutherland, dealing with the parishes of Lairg, Creich, and Dornoch.

Last month a railway was opened from Vologda to **Archangel**. Within three years the port on the White Sea will also be connected by rail with St. Petersburg, and by these means it is hoped that the town may regain some of the commercial importance it possessed before the foundation of St. Petersburg.—*Globus*, Bd. lxii. No. 16.

Prince Louis of Savoy reached the summit of **Mt. St. Elias** on July 31. The party spent fifty-one days in the ice and glacier region, and nowhere discovered any trace of volcanic activity. The height of the mountain was determined to be 18,120 feet, which is very close to Professor I. C. Russell's calculation, namely, 18,100 feet (see vol. viii. p. 159).—*Globus*, Bd. lxxii. No. 13.

Porpoises, which decimate the shoals of fish and break the fishermen's nets, are in the Turkish provinces of the Black Sea bordering on the Caucasus the object of an especial fishery. A school of porpoises is surrounded by floating nets of strong cord, and the fish are then killed with bullets. Large quantities of oil are exported annually to Trieste, London, and Marseilles.—*Revue Française*, October.

The archæologists sent by the Mexican Government to examine the supposed **Chinese inscriptions** in the Magdalena district have reported that they are genuine. A Chinaman has translated parts of them, and declares that they must be two thousand years old. This is in accordance with Chinese tradition, which relates that eighteen detachments of Chinese once explored the west coast of Mexico.—*Deutsche Rundschau*, Jahrg. xix. Heft 12.

The third **Italian Geographical Congress** will be held at Florence in the spring of 1898 ; the date is not yet fixed. General meetings will be held for the reading of papers and the discussion of subjects interesting to all students of geography, and special subjects will receive attention in four sections devoted to Scientific Geography (mathematical geography, cartography, physical geography, scientific explorations), Commercial Geography, Geographical Education, and Historical Geography respectively.—*Boll. della Soc. Geogr. Italiana*, vol. x. Fasc. 8.

In the October number of the *Journal of School Geography* is an account of a **Geographical Exchange Association**, which has been formed in the United States. Each member sends the secretary a list of products that he can supply from his district, and also of those he wishes to receive. The secretary distributes copies of these lists and a direct exchange is made easy. Photographs and lantern slides are included among the things exchanged. The Geographical Association might very profitably add this to its other plans for furthering geographical education, and might act as a medium of exchange between the teachers of this country and those in America.

We would again draw the attention of teachers to the *Journal of School Geography*, edited by Professor Dodge of the Teachers' College, New York. Although it is intended primarily for American teachers, there is much in it that is quite as useful for the British teacher, and makes it well worth the dollar a year that it costs. In the September number there is a model article on the Amazon Basin, in October the beginning of another promising one on the Yukon district; both not merely informatory, but full of matter of great educational value. Teachers interested in carrying on practical work in geography in schools will find two articles on laboratory work in elementary physiography.

The **Icelanders** feel keenly the want of telegraphic communication with Europe, and accordingly the parliament has accepted the offer of the Great Northern Telegraph Company to lay a cable from Scotland by the Färöe Islands to Iceland. Forty years ago Captain M'Clintock was sent to examine the sea with regard to the laying of a cable past Iceland and Greenland to Labrador, and gave in a favourable report. From Scotland to the Färöes the distance is 250 miles, and the greatest depth 250 fathoms. Thence to the Bernfiord in Iceland the distance is 280 miles and the average depth 300 fathoms; in one place it is 650 fathoms. The bottom consists of sand, mud, and shells. From the Bernfiord the telegraph line is to be carried past the Vatnajökull to the northern coast.—*Globus*. Bd. lxii. No 16.

A **Unifilar Anemometer**, designed by M. Barus, is noticed in *Ciel et Terre*, August 1st. Stronhal has proved that if the wind strikes a fine metallic wire perpendicularly to its axis it causes it to vibrate, the number of vibrations, n, being given by the formula $n = \frac{Cv}{d}$, where v is the velocity of the wind in mètres per second, and d the diameter of the wire in mètres. The value of C has a mean value of 0·2 at ordinary temperatures. The tension and length of the wire affect only the intensity of the sound. To measure n M. Barus connects the vibrating thread with a microphone. In consequence of its light weight the instrument gives the velocity of the wind at any moment, and not the mean velocity, like other anemometers, and by arranging three wires at right angles to each other, the components of the velocity can be measured, and the direction of the wind deduced from them.

Dr. Hassert, whose name is connected with the exploration of Montenegro, has this summer made an expedition to **Albania**. Arriving at Scutari early in June, he there waited until he had procured from the Porte permission to travel in the country. The order of the Turkish Government was indeed of little use to him, owing to the lawlessness of the people. However, he made several excursions to the Tarabos, to the Lubanj on the Drin, to the low plain of Braka, and of greater length to the Zukali mountains, and through the Miredita country to Prizren. Upper Albania is a wild country, where communication finds many hindrances amid a labyrinth of lofty mountains and deep valleys. The Turkish authority does not extend beyond the lowlands round the lake of Scutari and a few frontier places towards the interior. Elsewhere the inhabitants are completely independent, and pay no imposts, and, as the various tribes live in constant feud with one another, there is great insecurity, and barbarism and anarchy are rife.—*Geographische Zeitschrift*, October.

Two fleets sent by an English shipowner, Mr. F. W. Popham, to the **Ob and Yenesei**, have returned to the Thames after a successful voyage. Sailing at the end of July, they passed through the Yugor Strait into the Kara Sea and skirted

the west coast of Yalmal, where the water is shallow and sandbanks numerous, so that the sounding-line was in constant use. Having passed White Island, the fleets separated, the one going east to the Yenesei, while the other turned into the Ob estuary, and in spite of the difficulties of navigation safely reached Nakhodka Island in the eastern arm of the gulf. The station for the summer trade is in a swampy country at about 68° N. lat. The nearest town is Obdorsk, 200 miles to the west. About a hundred men, half Russians and half Samoyedes, were sent from Tiumen to meet the fleet and assist in the unloading. They brought in their long boats wheat, flour, barley, hemp, and horsehair, while the imported article was brick tea, for which there is great demand in Siberia. Though the land route from China is much shorter than the sea route round the south of Asia and Europe, it is believed that this trade may yield a satisfactory profit.

Geographical Models.—Professor W. M. Davis has a useful paper on geographical models in the twenty-eighth volume of the *Proceedings, Boston Society of Natural History*. Models may be divided into two groups, those that represent an actual land surface, and those that represent an ideal one.

Of the models of actual conditions, those for a large region teach more errors than facts, and all the cheap purchasable models of countries we have seen are of this class. Such models, however, if the area represented is not too great, can be accurately made, and the beautiful reproduction of Italy on a truly curved surface made by Del Pomba should be inspected in the Edinburgh Museum by every teacher. Models made for smaller areas on a larger scale can show the physical features even better, and Mr. Guyou's model of Edinburgh and the District in the Outlook Tower, Castle Hill, is excellent, and serves to correct the exaggerated ideas most of us have of the relationship of vertical to horizontal distances.

Models of ideal surfaces are useful in teaching general geography. Professor Davis mentions four made by Professor Heim, which can be bought from J. Meier, Zürich. "They represent a high mountain district with snowfields and glaciers, an Alpine torrent, a volcanic island, and a cliff and dune coast." Professor Davis has devised another set of ideal models, which stand in systematic sequence, and illustrate the relationship of different forms and the principles of geographical evolution. They are 24 by 18 inches, and the relief is nearly 2 inches above sea-level, and show (1) mountains bordering the sea, such as are found in the north-east of Spain; (2) a narrow coastal plain between mountains and sea, which illustrates the conditions east of the Deccan; and (3) a mountainous region descending to an irregular shore line—such as the south-west of Ireland, or Greece. The second model may be constructed by extending the front of the first, and the third by cutting off a section from the lower part of the first, with a few modifications along the new coast-line. The photographs of the models show that they are admirably planned and executed; and if they can be had at reasonable prices, they should form part of the equipment of every well-furnished school.

Imperial Institute.

We are requested to state that a **Commercial Reading-Room**, free to the general public, has been opened in the Imperial Institute for the convenience of merchants, manufacturers, and others, resident in, or visiting, the Metropolis. A large number of commercial and technical publications are kept in the room, as well as trade circulars, information in regard to shipping, transit by rail, etc. Maps of the colonies are exhibited, and the maps and charts in the map-room of the Institute may be consulted on application. Works on the colonies and India are procurable by the public for perusal on filling up application forms.

NEW BOOKS.

The Tenth Island; being some Account of Newfoundland. By Beckles Willson. London: Grant Richards, 1897. Pp. xix + 208. *Price* 3*s.* 6*d.*

In the August number of this *Magazine* we noticed the second edition of Dr. Prowse's comprehensive work on the history of Newfoundland. The volume now before us is less pretentious, and purports to be for the most part a description of the Newfoundland of to-day. It confirms in every respect the opinion we formed of the island from the description given of it by Dr. Prowse, and we regret to find that the local difficulties and drawbacks which prevented Newfoundland some years ago from finding salvation by joining the British North American confederacy, still exist, and seem to be even more acute now than they were then. On the other hand, a determined and fairly successful effort is being made to develop the resources of the island, and, in particular, attention is being paid to the improvement of its means of communication. A Scotchman, Mr. Reid, has not only constructed a railway right across the island, but has contracted to work it for ten years. His profits are estimated at half a million sterling, and he has already received from Government a grant of two and a half million acres of land, which makes him probably the owner of the greatest estate in the world. The advent of the railway has given a considerable impetus to roadmaking, mining, and other industries, and to the development of the country in general. There is abundance of copper and coal in the island, and gold, silver, lead, asbestos, iron, etc., have been found in various localities. Capital and population are wanting, and especially skilled labour. The fisheries are as productive as ever, but competition with Norwegians and French, assisted as the latter are by handsome bounties paid by the home Government, renders the industry less lucrative than it was, and points to the urgent necessity of finding new markets and more rapid means of transport for fresh fish. The monograph will be useful to those of our readers who do not care to tackle the more voluminous work of Dr. Prowse.

With the Dutch in the East. An Outline of the Military Operations in Lombock, 1894, giving also a Popular Account of the Native Characteristics, Architecture, Methods of Irrigation, Agricultural Pursuits, Folklore, Religious Customs, and a History of the Introduction of Islamism and Hinduism into the Island. By Captain W. Cool (Dutch Engineers), Professor at the High School of War, The Hague. Translated by E. J. Taylor. Illustrated by G. B. Hooyer. London: Luzac and Co., 1897. Pp. viii + 365 + x. *Price* 21*s.*

Were this *Magazine* devoted to the interests of history instead of geography, this book would furnish a fitting pretext for inquiring into the causes of the decay of Dutch military and naval energy since the close of the seventeenth century. What a contrast is presented between then and now! Formerly the Netherlands defied the might of the strongest Power in Europe. Now she wages ineffectual war for many, many years against a small Malay state in Sumatra. Captain Cool's narrative affords another example of how feebly the Dutch manage *their* "little wars." Captain Cool himself appropriately enough puts his finger on the root of the weakness, when he blames the "want of initiative, a shrinking from making a bold attack, from taking the offensive, a want of that quality which stamped our forefathers, which sent them in search for (*sic*) dangers, and enabled them to vanquish them." . . . "Once again, instead of taking the initiative, we see all attention turned to preparations for defence and for safety."

The greater part of this book is occupied with the narrative, going into the minutest particulars, of the military campaigns against the chiefs of Lombock, in which, after suffering reverses (which ought not to have been incurred), the Dutch colonial army finally accomplished the task that was set it. There is also a useful summary of the geography of the island of Lombock, based principally upon the works of Zollinger, Freyss, Jacobs, Van Eck, Wallace, Liefrinck, Van Bloemen Waanders, and others. The student of religious and social customs will find much extremely useful information in these pages. Captain Cool dwells especially upon the Hindu influences which have left a lasting stamp upon the people of this island.

The book is, on the whole, very creditably translated. The illustrations, of which there are a great number, materially help to the understanding of the text. And there is an excellent index. Unfortunately, the book having been set up in Holland, there is a larger quantity than usual of misprints—*e.g.* "oevelopment" (p. 113); "equipenent" (p. 43); "vollies" (p. 223). On p. 148 Gunong Rindjani should be 12,000 (not 1200 ft. high), as on p. 151 an altitude of 8000 ft. is spoken of, and the map gives its summit as 3755 mètres (=12,320 ft.).

Guide de la Section de l'État Indépendant du Congo à l'Exposition de Bruxelles-Tervueren en 1897. Ouvrage publié sous la direction de M. le commandant Liebrechts, Président du Comité exécutif, par les soins du Lieut. Th. Masui. Bruxelles: Imprimerie Veuve Monnom, 1897. Pp. xiv+524.

Messieurs J. Lebègue et Cie. of Brussels have been courteous enough to send us a copy of the official *Guide* to the section of the Congo State in the Brussels Exhibition of this year. It is a goodly volume of 525 pages, and is profusely illustrated. The *Guide*, however, is not a mere catalogue of the exhibits from the Congo. On the contrary, it is a treatise in which the reader who is interested in the subject will find such a mass and variety of minute information regarding the Congo, as has, so far as we know, never been compiled into one volume before. After an introductory chapter on the Art of the Congo, we have Part I., which treats of the country from historical, physical, political, and ethnographical points of view. Part II. is devoted to the economics of the country—its geology, fauna, flora, products, and commerce. The work is a mass of details, and indicates that no pains or trouble have been spared in its compilation. Even the work of solitary missionaries finds mention. The beneficent influence of Protestant missionaries is handsomely acknowledged. We quote two passages, in the first of which certain American missionaries are presented in what is probably a new light to our readers. In the second the general position of the Protestant missions is stated.

"Une mission curieuse est la B. T. S. (Bishop Taylor's Self-supporting Mission). Fondée par un Américain, M. Taylor, elle a pour principe de se borner à remettre à ses missionaires leur ticket de voyage et leur équipement. Une fois au Congo ils doivent se 'supporter' eux-mêmes, subvenir à leurs besoins. Ils se livrent pour cela à la culture et *surtout à la chasse*."

"D'après le même auteur (Scott Robertson) en Grande Bretagne seulement, les missions étrangères protestantes recueillent une somme annuelle de 1,374,753 livres sterling (34,268,325 francs)!" "Les missions sont très bien installées: les bâtiments sont gais et propres, et on y rencontre dans la mesure du possible le confort que tout Anglo-Saxon sait toujours se procurer où qu'il aille. Les prédicants sont généralement zélés et désireux de bien faire et, dans certaines parties du Bas-Congo ils ont réussi à apprendre les cantiques sacrés et la lecture de la Bible à plusieurs milliers de noirs qui subissent leur influence. C'est, du reste,

surtout dans le Bas-Congo que convergent leurs efforts. Au moins cent cinquante de leurs missionaires y sont installés et ont réussi à se faire accepter des populations qui se réunissent autour d'eux, le dimanche, au son de la cloche de la mission, pour entonner les chants dominicaux et lire le livre sacré. Les protestants ont appris à lire et à écrire à leurs élèves, et même ils ont établi une imprimerie, laquelle publie un journal en langue congolaise. Quelques écoles ont maintenant un enseignement en langue française, mais la seule langue européenne généralement enseignée est l'anglais ; pas un seul de ces missionaires n'est, d'ailleurs, de nationalité belge." And it seems as if the writer was not very satisfied with this state of affairs, for he concludes thus, "il est incontestable que les sociétés protestantes ont accompli un effort considérable au Congo, et qu'en plusieurs endroits leur influence est devenue très sérieuse."

Three Years in Western China. By Alexander Hosie, M.A., F.R.G.S. Second edition. London : George Philip and Son, 1897. Pp. xxvii + 302. *Price* 6*s.*

Mr. Hosie, of the Chinese Consular Service, has published a second edition of his interesting account of his travels in Western China in 1882-83-84. The second edition is an exact reproduction of the first, with the exception that all but one of the illustrations have been omitted ; a preface has been added in which the author gives much valuable information as to the trade which has recently sprung up in Western China. In 1890-91 Ch'ung-K'ing was declared an open port by a supplementary treaty at Pekin, but with the remarkable reservation that British steamers were not to be allowed to ply on the Yang-tsze until Chinese steamers began to do so. The Chinese traders put no steamers on the river, so the new article in the treaty was of no benefit to British trade. But after the Japanese war of 1894-95 Ch'ung-K'ing was declared an open port for Japanese trade, including commodities and passengers conveyed by steam. When Ch'ung-K'ing had been declared an open port in 1891 a British Consul was sent there, and the usual statistics of imports and exports were prepared. Of these Mr. Hosie gives an interesting and instructive *précis*, showing that, even when the trade was confined to junks, some two-thirds of them were in the hands of the British. Perhaps the most important passage in this interesting preface is a quotation from the report of the Commissioner of Customs, dated so long ago as 1891, in which he points out that of late years much attention has been paid to the production of unadulterated opium, and that in a favourable season "the out-turn of the poppy-fields of Western China alone are ample to the ordinary requirements of pretty nearly the whole Empire." He adds that "the fact is patent, that as regards her opium supply China is now practically independent." What this may mean to our already impoverished Indian empire can easily be imagined.

The exports of Ssu'ch'uan are opium, white wax, silk, medicines, etc. The foreign imports are yarns, shirtings, cotton and woollen lastings, etc. ; the native imports are raw cotton, silk, piece goods, medicines, etc.

Mention is made of the French attempts to open up a trade with Western China from Tonquin and the Red river, and its statistics from 1890 to 1895, both years inclusive, are given. In these years the imports increased by about 200 per cent., and were in value about £600,000 ; the exports increased by over 100 per cent. and were in value about £340,000. The imports are principally Indian cotton, yarns, and tobacco, and the exports tin in slabs and Yünnan opium. But the statistics also show that nearly the whole of the imports were consumed in Yünnan, and did not reach Ssu'-ch'uan. Mr. Hosie still adheres to the opinion he expressed eight years ago, that "the only route to Ssu'-ch'uan, Kuei-chow, and

Northern Yünnan is the Yang-tze," and "the long journey overland from Mêng-tzû, or rather Man-hao, to Ssu'-ch'uan, Kuei-chow, and Northern Yünnan is, in my opinion, an insuperable barrier to a successful rivalry of the Red river with the Yang-tsze."

Not much advantage to British trade in Western China is to be anticipated from the London Convention of 1894, which settled the conditions of trade between Burma and China. Western China is too distant to profit by the new agreement between London and Pekin; but it is the object of acute commercial rivalry between England, France, and Japan, so a considerable and rapid development of its trade may confidently be expected.

En Congé. Égypte, Ceylan, Sud de l'Inde. Par Georges Noblemaire. 2me édition. Paris: Hachette et Cie., 1897. Pp. 319. *Price 3 fr. 50 c.*

In a tourist's notebook on a well-worn journey, the author invests his subject with interest, thanks to a perspicuous style and lively narrative. He arrived in Cairo in December 1896, and his descriptions of that city and the subsequent trip up the Nile are written with care and ability. He exhibits no animosity to the British occupation of Egypt. At the same time, as the following passage shows, he thinks he knows all about British policy in Egypt:—"One thing is certain that, at the Mahdi's death, the history of Alexander's lieutenants was repeated, and the Mahdi's empire, torn by dissensions, is in rapid decay. England is waiting till the pear is ripe, and then, when she has only to gather it, she will devour it, and that means all the Upper Nile as far as the fertile shores of Lakes Albert and Victoria—yes, the whole Soudan will suddenly drop into the pocket of John Bull. We may then recommence our discussions regarding the evacuation of Egypt, for the Nile route will no longer be indispensable once the railway conveys the produce of the Soudan direct to Suakin. That veritable golden egg of British officialdom, the Egyptian budget, will have done well, and the hour will at last have come to execute those famous promises which England always intended to keep—yes, at the proper time! Then we shall discover that the people of Egypt have received a sufficient education, and that the wise counsels and prudent control vouchsafed by benevolent Albion have rendered them worthy to govern themselves."

Ceylon and South India were also visited, and are described in a series of picturesque and masterly sketches.

Les Africaines. Contribution à l'Histoire de la Femme en Afrique. Par le Lieutenant Lemaire (Charles) du 5e Regiment d'Artillerie. Brussels: Ch. Bulens, 1897. Pp. 256.

This very curious study of Woman in Africa is by a Belgian officer of artillery, who was stationed for four years in the C ngo State as "Commissaire du District de l'Equateur." His own researches are confined to that State, but he has gleaned from the works of many African travellers their opinions on African women.

Lieutenant Lemaire's monograph is not merely of ethnographical interest, it is also of humanitarian and religious importance. He pleads for the establishment in Belgium of a society analogous to the "Union des Femmes de France." He maintains that the regeneration of Africa is largely in the hands of the white woman, who must, however, go to the rescue of her sable sisters and live among them. He points out that during the last five or six years the heart of Africa has been reached by European ladies (almost all English or Belgian) proceeding up the Congo. The number of Protestant missions has, he says, increased enormously on

the Congo, there being no fewer than fifty-six founded by British, American, or Swedish Protestant societies; and he maintains that the family life enjoyed by the Protestants, who live happily on the Congo with their wives and children, has been the means of preserving and establishing them in a manner which is not enjoyed by the Belgian officials.

With regard to the ethnological (being the major) portion of the volume, the author discusses the habits and peculiarities of the women of the Southern Mediterranean coast, Arabia, the Touareg country, Fez, Tibesti, the oasis of Kaouar, Lake Tchad, Central Soudan, Upper Niger and Timbuktu, Senegambia, Sierra Leone, Gulf of Guinea, Ivory Coast, Slave Coast and Dahomey, Benin, Lower Niger, Gaboon, and the Congo. The illustrations are as numerous as they are excellent, and, besides the author's own sketches, comprise illustrations after photographs by Dr. Drye-pondt and Major Fivé, both officials of the Congo State.

Une Mission française en Abyssinie. Par S. Vignéres. Paris: A. Colin et Cie., 1897. Pp. 224. *Price* 4 *fr.*

Secretary to the mission sent, in November 1896, by the French Government to the Negus Menelik, the author here gives from his diary his notes of travel through Abyssinia. With that fondness for autocrats which distinguishes his compatriots, M. Vignéres writes with enthusiasm of the Negus, adding:—"It is impossible to form an idea of this sovereign from the wretched photographs of him we possess in France." M. Vignéres has therefore recourse to the following word-picture:—"The Negus has the majestic appearance of a monarch sure of himself and conscious of his power. When he greeted us, which he did with ease, his face beamed with good humour, and his eyes sparkled with intelligence. When he smiled, or when a reply of our chief appealed to his heart, his features became transformed and suddenly illuminated, his countenance seemed full of life and his eyes arrested attention. We felt we were in the presence of a man at once beneficent, large-minded, and humane." Sportsman as well as traveller, M. Vignéres' book is an instructive commentary on an interesting country.

Histoire de l'Amérique du Sud depuis la Conquête jusqu'à nos Jours. Par Alfred Deberle. Paris: Félix Alcan, 1897. Pp. xix+416. *Price fr.* 3.50.

Most people in this country have only very vague ideas about the South American republics. The impression we gain from reading the newspapers is that those republics are in a state of chronic revolution and bankruptcy. We regret to have to confess that M. Deberle's history only strengthens this impression, but a perusal of it will enable us to better understand the causes of this unsatisfactory political condition. The horrors of the Spanish conquest in the sixteenth century were even surpassed by the atrocities of the subsequent colonisation. The Spanish colonists behaved like fiends let loose upon the native population, only the Jesuits in Brazil making some attempt to check the mad fury of their fellow-countrymen. Nothing more insane can be imagined than the administration of the country under Spanish and Portuguese rule. Those Governments had not the faintest thought of developing its resources; their only object was to extract the precious metals and to destroy the natives. As is well known, native labour became so scarce that Negroes had to be introduced. However, the French Revolution and the Declaration of Independence of the United States of North America roused the people, and in 1826, after fifteen years of heroic struggles, in which Bolivar rendered his name immortal, the last Spanish soldier left the country. But Spanish misrule has

left a lasting inheritance. Gradually, and only after much bloodshed, new States formed themselves, but their history up to the present time is a record of more or less sanguinary revolutions. Only Brazil and Paraguay followed a different course, the former enjoying a spell of peaceful development under the constitutional monarchy of Pedro II., the latter under the autocratic rule, first of the Jesuits, and then of the Dictator Francia. At present the political condition seems to be much the same all over the continent—instability and unrest. M. Deberle's very readable account has been brought up to date by M. Milhaud, and well repays a perusal; it deserves to be translated into English.

Health in Africa. A Medical Handbook for European Travellers and Residents, embracing a Study of Malarial Fever as it is found in British Central Africa. By D. Kerr Cross, M.B., C.M., F.R.G.S., Medical Officer for British Central Africa Protectorate. With an Introduction by Sir Harry Johnston, K.C.B., H.B.M.'s Commissioner for British Central Africa Protectorate. With numerous Illustrations. London: James Nisbet and Co., Limited, 1897. Pp. 198. Appendices and Index. *Price* 3*s.* 6*d.*

In his introduction to this work Sir Harry Johnston states that "No medical man of my acquaintance is so fully versed as he (Dr. Kerr Cross) is in the study of African diseases." This is high praise, and the Commissioner of the British Central Africa Protectorate ought to know, as he has had long experience in the malarious regions of the dark continent. He also recommends all Europeans about to settle in Tropical Africa to read and follow the advice given in the book closely. We are glad to indorse this recommendation on the whole, for the author has written a book which cannot fail to be of use.

It is always a difficult matter to write a guide for the use of non-professional people; there is the danger of saying too much, and of ordering very potent remedies, which, although they may be prescribed with safety by a medical man, are by no means without danger in the hands of those only possessing "the little knowledge" which is so dangerous. We think our author is rather too free in advising so often the use of hypodermic injections of morphia and the use of such drugs as sulphonal, antipyrine, chloral (30 grain dose for sleeplessness is, we think, too large), antifebrin, phenacitin, etc., although we admit the value of these drugs when given with care and full knowledge.

Apart, from this, the advice given is admirable, and an intelligent reader cannot fail to be fairly well equipped for his struggle against disease by its careful study.

The vital subject of malaria is well and clearly handled, and the treatment, which is fully explained, is safe and good.

We think that Dr. Cross should have provided rather better diagrams, and hope that he will do so in a new edition. The text, too, would bear a little revision, as in parts it shows some signs of haste, and some sentences are rather irritating to the reader. The index is full and the appendices are valuable. We would strongly advise all persons going to Africa to obtain a copy.

Méthode Graphique pour la détermination des heures approchées des Éclipses du Soleil et des Occultations. Par L. Cruls. Rio de Janeiro, 1894.

Although graphical methods for determining approximately the local circumstances of Solar Eclipses and Occultations of stars by the moon cannot take the place of the rigorous computations, they are nevertheless of much use to the computer in providing him with a check on his work. An expeditious method of this kind is given by M. Cruls, Director of the Observatory of Rio de Janeiro, in his

Méthode Graphique, the principle of which is the laying down, by means of rectangular co-ordinates, of the places of the moon's centre, as affected by parallax in hour-angle and declination, for certain instants near the time of conjunction and separated by intervals of one hour of mean time. The plane of projection is perpendicular to the straight line joining the observer's place and the centre of the true moon at one of the instants chosen, the X axis is the parallel of declination passing through the moon's centre, and the Y axis the circle of declination through the same point. The line joining the places thus found represents the apparent path of the moon, and if the place of the sun (with suitable allowance for parallax and hourly motion), or of a star, is also laid down for the moment of geocentric conjunction, it is easy to find by means of a scale the places of the moon's centre at the Contacts in the case of a Solar Eclipse, or at Immersion and Emersion in the case of an Occultation, as well as the times at which these occur. Six tables, adapted to the data furnished by the Nautical Almanac and applicable to all geographical latitudes, are given for facilitating the computation of the parallactic displacement —three decimal places being sufficient for the degree of accuracy aimed at.

Two examples taken at random in order to test the method—viz. the Occultation of η Tauri 1898, January 3 at Edinburgh, and the Total Eclipse of the Sun 1898, January 22 at Nagpur, India—give results which agree satisfactorily with the rigorous computations.

This graphical method cannot fail to be of service to the computer, but it is to be regretted that M. Cruls has not adhered to the signification of the symbols ϕ and δ universally adopted by astronomers, and has thus introduced a vexatious source of possible error.—A. J. R.

The Discovery of North America by John Cabot. By Henry Harrisse. London : B. F. Stevens, 1897. Pp. 47.

This is an expansion of an article that appeared in the June number of *The Forum* this year, and is Mr. Harrisse's latest contribution to the Cabot controversy. In it he argues strongly, in opposition especially to Dr. Dawson and Mr. Weare, that we have not satisfactory evidence as to the time or place of John Cabot's landfall, and that the documents giving the name *Matthew* to his vessel are open to grave suspicion.

Captain Cook's Voyages round the World. With an Introductory Life by M. B. Synge. London, etc. : Thomas Nelson and Sons, 1897. Pp. xiv + ix + 512.

This handy volume contains the narrative of Cook's three voyages only slightly abridged from the folio volumes of his journal. The journal of the first voyage, edited by Captain Wharton, has been made use of by permission of the publishers. The *Life* by Mr. Synge contains all the chief events in a few pages.

The illustrations are neat and instructive ; some of them are reduced from the original plates to Cook's journals. But a map showing the tracks of Cook's vessels would be a valuable addition, for it would be much more useful than the small maps of Australia, New Zealand, etc., given in the volume.

Annales de Géographie. Bibliographie de 1896. Paris : Armand Colin et Cie.

The editors of the *Annales*, a publication which has rapidly acquired a well-deserved reputation, have issued their bibliography for the sixth year of the existence of the periodical. Great care has been exercised in the selection of the

most important books and articles published during the year in question, and notes are appended on the contents of the publications. The editors have been assisted by able co-operators in all the chief countries of Europe, and have thus been enabled to produce a solid and useful work.

Great Britain. Switzerland and the Adjacent Portions of Italy, Savoy, and Tyrol. Handbooks for Travellers. By KARL BAEDEKER. Leipzig: Karl Baedeker, 1897.

The former of these *Guides* has reached its fourth edition, and, as in the case of all the series, shows considerable improvement. It contains information on all the parts of England which are of interest to tourists. Comparatively few pages are devoted to Scotland, but no great places of resort or important routes are omitted, though in some cases only briefly mentioned.

Swiss guide-books are bound to increase, as visitors are ever in search of new resting-places in that much-frequented country. Baedeker's handbook contains the latest information and several additional maps and plans.

The "Contour" Road Book of England (Northern Division). By HARRY R. G. INGLIS. London and Edinburgh: Gall and Inglis, 1897. Pp. xiv + 240. *Price* 3*s.* 6*d.*

Mr. Inglis is now extending his excellent method of treatment to the English roads. The present volume describes the roads as far south as the counties of Derby and Nottingham. Mr. Inglis' method was described in vol. xii. p. 495, and we need now only heartily recommend the new work to all travellers by road, especially cyclists.

Handy Guide-Book to England and Wales for the use of Visitors in this Country. By EDWARD SMITH. London: George Allen, 1897. Pp. xxxviii + 356. *Price* 7*s.* 6*d.*

A visitor requires more detailed information on the parts of the country most worth seeing, and the railway lines by which they may be reached, than an inhabitant does. This need is somewhat inadequately provided for in the *Guide.* It is true that in the Introduction sketches of tours are given, but there is little facility afforded to the tourist to make out his own route, embracing those parts he would personally wish to see. The remainder of the book is in gazetteer form, after the style of Murray's *Handbook.* The descriptions are, as a rule, accurate, if rather too brief. One or two mistakes, however, have been allowed to slip in; the brine springs at Nantwich, Cheshire, are exhausted, and no longer "attract visitors for bathing"; and again, the town of Windermere is not on the "side of the lake," but more than a mile from it.

Illustrated Pocket Guide to Melrose, Abbotsford, etc. (The Land of Scott). By RALPH RICHARDSON, F.R.S.E., F.S.A.Scot. Edinburgh: John Bartholomew and Co., 1887. Pp. 61. *Price* 1*s.*

The *Guide,* originally issued in 1892, has been considerably enlarged by the addition of an appendix, wherein are described a number of routes leading to the most interesting spots in the neighbourhood. Full details are given of distances, etc., and the maps have been improved. No better guide to the locality need be desired.

NEW MAPS

EUROPE.

ENGLAND AND WALES, Bartholomew's four miles to the inch Road Map of ——. From the Ordnance Survey. In 12 sheets. *Price, cloth 2s. per sheet.*
The Geographical Institute, Edinburgh.

NORTH NORTHUMBERLAND. NEW FOREST AND ISLE OF WIGHT. Bartholomew's Reduced Ordnance Survey. Scale two miles to an inch. *Price 2s. each.*
The Geographical Institute, Edinburgh.

ASIA.

SOEMATRA, Algemeene Kaart van ——, Bangka en den Riouw-Lingga Archipel. Door Dornseiffen en Pleyte. Schaal 1 : 1,000,000. *Prijs in 12 bladen F. 7.50.*
Seyffardt's Boekhandel, Amsterdam, 1896.

This is a second edition of the map of Dr. I. Dornseiffen issued in 1893. Since that date many surveys have been made in the island, and several explorers have brought home fresh cartographical material, and therefore the publishers determined to reprint the map. Heer C. M. Pleyte, Wzn, has done the work of revision. The map is in twelve sheets and contains two insets, one of Groot Atjeh and the environs, and the other of the Padang district, with the railway to Fort de Kock and the Ombilien coalfield. With all the latest material at his disposal the reviser has produced a most excellent map, a copy of which is almost indispensable in a library. The execution is clear, though not highly artistic.

NORTH-WEST INDIAN FRONTIER, War Map of the ——. Scale : ten miles to an inch. *Price 2s. cloth.* *W. and A. K. Johnston, Edinburgh.*

—— —— ——. Bartholomew's Special Map of the ——. *Price 1s.*
The Geographical Institute, Edinburgh.

Both these maps are good, each in its way. The former, showing only the frontier from near Chitral to the Zhob river and on a larger scale, is more especially a war map. The latter extends also over the Pamirs and as far south as Patna and Karachi.

AFRICA.

EGYPT AND THE LOWER NILE. Bartholomew's Tourists' Map of ——, prepared from the latest Survey. Scale 1 : 1,000,000. *Price 3s. cloth.*
The Edinburgh Geographical Institute.

This new map deserves special mention. It is carefully compiled from the latest Government and other publications and thoroughly well executed. Besides the large map showing the Nile from the sea to Wady Halfa, there are insets, one of the Nile up to Khartum, the other of the environs of Cairo.

The terminus of the railway from Cairo up the Nile is known in *Guides*, etc., as Nagh Hamâdi, and it would have been well if this name could have appeared on the map, say, in brackets, under Abu Hamâdi, which is, we believe, the authorised form.

CHARTS.

MONTHLY CURRENT CHARTS FOR THE ATLANTIC OCEAN.
Presented by the Meteorological Council.

A series of six charts compiled from log-books of vessels, and intended as aids to navigation. The currents, therefore, north of the British Isles and in the extreme south—except in the neighbourhood of Cape Horn and the Cape of Good Hope—do not appear. The style is similar to that of the charts for the Indian Ocean, noticed last year.

GENERAL MAP OF
QUEENSLAND
REDUCED FROM THE LATEST SURVEYS
TO ILLUSTRATE Mr T P THOMSON'S PAPER
GULF OF CARPENTARIA
PENINSULA
YORK
CAPE
TORRES STRAIT
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SOUTH
SOUTH AUSTRALIA
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SESSION 1897-1898.

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SCOTTISH GEOGRAPHICAL MAGAZINE.

Back Numbers of the *Magazine* may be purchased by Members at the following price :—Vols. I. to XIII., unbound, 10s. 6d. per vol., post free; bound, 12s. 6d. per vol., post free. The separate parts from January to October 1897, inclusive, may be obtained for 8s. 6d., post free. Separate Numbers may be purchased by Members for 1s. each.

Cloth boards, according to the official pattern, may be had on application to the Printers, Messrs. T. & A. CONSTABLE, University Press, Thistle Street, Edinburgh, price 1s. 3d., post free. (Case for Vol. XIII. ready early in January.)

BOOKS AND PHOTOGRAPHS.

The Library, being of comparatively recent formation, does not contain many of the older works of Travel and Geography which are frequently needed by students, and therefore any such volumes which members may have at their disposal will be gladly received by the Society.

Photographs, also, illustrative of foreign life and travel, physical geography and geology, etc., will be very acceptable. They should be accompanied by descriptive titles and, if on sale, with the names and addresses of the photographers.

LEGACIES.

The Society is anxious to accumulate a fund to consolidate its usefulness in promoting geographical research. Persons who are inclined to benefit the Society by Legacies are recommended to adopt the following

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THE SOCIETY'S ROOMS,
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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ANAGA AND ITS ANTIQUITIES.

By Don Manuel de Ossuna y Van Den-Heede.

Translated by Miss M. W. Macdowall.

It cannot be doubted that the valleys of Anaga still retain the most primitive characteristics of the Canarian archipelago; not only is this the case because of their lofty mountains and virgin forests, but because the whole district forms the most salient prolongation of the island of Tenerife, and, isolated as they are by the high crests of its mountains from every centre of population, its inhabitants, who are shepherds for the most part, live completely cut off from all influences of the outer world. They are thus able to preserve the simple and patriarchal customs of their ancestors.

Thanks to these peculiar circumstances, the Caucasian type, which we are assured by our earliest chroniclers was dominant amongst the indigenes of this district at the time of the Conquest, has been transmitted from generation to generation up to the present day. It is clearly visible in the correct lines of the head, the finely cut features and tall stature of the men, as well as in the delicate complexion, large eyes, and statuesque figures of the women. Besides all this, the numerous local words and expressions used by the country people, some of their extraordinary customs, and the great number of traditions and legends of the place, are well calculated to form an inducement, both to the ethnographical student and to the ordinary tourist, to visit and examine this part of Tenerife.

The population of Anaga must have been very considerable before the Spanish invasion, to judge by the great number of ancient dwelling-places and sepulchral vaults that are still to be seen on the sides of the mountains and hidden away in the cavities of the rocks. More especially

are these to be found on the precipitous slopes which extend from the high ground above Chirindaque to the cliff of Anambro, where the country was more densely peopled than in other parts, thanks to the peculiar advantages enjoyed by those who lived in that particular region. It would be impossible to find anywhere on the southern coast between Añaza and Chirinda on the Asqua road, or on the northern shore from Guanak to Tafada, a district more favoured by climate, or with a better strategical position, than that now under consideration. For this reason, as well as because of its fine pastures, its abundant waters, and its great variety of wild fruits, the old kings of Anaga were induced to fix their residence here, as did also those tribes which were richest in flocks and herds. So, at least, we are informed by the scanty historical traditions still preserved in the neighbourhood. These traditions we have been at great pains to collect from some of the oldest inhabitants, sifting them carefully.

The antiquarian will be interested to learn that an enormous cave is to be found in this part of the country. It is situated in the district known as the Laderas (slopes) del Barro, and in it may be seen all that remains of the ancient dwelling-place of the kings of Anaga. It possesses a wide entrance hall, where you can even now discover traces of the old stone seats that were used when the monarch gave audience to his vassals. By climbing a hill, not very far from this spot, you reach the high level known at the present day by the name of the Llano de las Cancelas, whence there is an extensive view over a beautiful plain, in which an army of some three or four thousand men might be formed in battle array. This plain is known by the name of El Tagoror, because it was there that the *Menceyes* met their counsellors and other subjects in order to discuss affairs of state, or administer justice to the people. Descending the hillside in a northerly direction, and passing almost immediately behind the ancient stronghold mentioned before, you come to an extremely pretty grotto, which, until lately, was surrounded by a grove of laurel and heath trees. Here, according to vague legends, was the scene in which the love story of Princess Guacimara and the valiant warrior Ruiman of Güimar was enacted. The interior is carpeted with moss, and a little crystalline stream gushes out, adding a greater loveliness to the spot, which is still called the Cueva de la Visogue. Returning to the royal cave, we find the remains of an ancient habitation at a short distance from it. Tradition has it that this dwelling belonged of old to a prince, and it is known as the Corral de Icobro. All around may be seen vestiges of other habitations that throw a certain light on the weird and mysterious legends which are yet preserved, in a rather incoherent form, by the natives of the district.

Here there is a splendid view of the distant slopes of Anosma, great white cliffs which mark the sanctuary of the *Magadas* of Anaga, as the virgin priestesses were called who were consecrated to the service of the divinity, and whose intervention in matters, both religious and political, was repeatedly invoked by the king and his counsellors. Close to the entrance to these curious precincts traces of the old stone seats are distinguishable on the rock, while within the sacred enclosure (which is

quite large enough to contain a herd of cattle) cavities may be seen similar in form to the niches for ex-votos that are to be found on the Pnyx or in the grove of Daphne. We learn from tradition that this sanctuary was inhabited after the Conquest by a certain family whose original name has been forgotten, but which was known after the introduction of Christianity as the family of Juan Sanchez, and, moreover, the cave is called the Cueva de Juan Sanchez to this very day, while its surroundings are always spoken of as Las Magadillas. Not very far from here is the Cueva de los Palos, celebrated for its horrid sights and sounds, including visions of ghosts and demons, and possessing the further peculiarity of depriving all who entered it of the power of laughter, as in the case of those ancient Greeks who were rash enough to go into the cave of Trophonius. Furthermore, as we learn from a legend, dating from a period anterior to the Spanish invasion, awe-inspiring and terrific sounds were often heard in the bowels of the mountains round about, similar to those which the trembling inhabitants of Lebadea used to hear close to the grotto mentioned above. On the mountain-sides, in a south-easterly direction, a good many black objects are perceptible, remnants of the old dwelling-places of the Chimber tribe, and farther away, on the other side of the *barranco* of Ujana, are the caves in which the tribe of Korosmas resided; indeed, the residences of the tribal families of Chirinda, Vichuelo, Larvicho, Asano, Vigogia, Tajana, Afono, Chinobe, Icono, Vegio, etc., will be found scattered all around at longer or shorter distances from each other, as well as those of several others, whose names are still preserved by tradition, to the number of eighty, a note of which we have already sent to the Marquess of Bute, who is at present endeavouring to solve the knotty problem as to what was really the original language spoken in the Fortunate Islands.

One of the most notable amongst the sepulchral caves is that denominated the Cabezo de los Muertos. It is situated on a height some three kilomètres to the west of El Tagoror. The indigenous name of this important necropolis has been lost; but, according to tradition, it serves as the last resting-place of several christianised Guanche families. It is very difficult of access. It consists of a long chamber or gallery, furnished with a wide settle running along either side of it, in the same manner as those that are to be seen in the residence occupied by the powerful king of Taoro (Orotava) in the summer time. Another burial-place, called Vegeril, lies at no great distance from this one. It was discovered in 1860 by two shepherds, who unfortunately destroyed the innumerable mummies and other remains that had been preserved in the cave. Lastly, we may mention the sepulchre that was accidentally found by some other shepherds in 1889, and out of which ten skeletons and a mummy in sufficiently good preservation were taken. The provincial newspapers at once announced the find, and shortly afterwards we were ourselves able to acquire some of these valuable remains. In 1890 we visited the cave in company with our friend the naturalist, Don Anatael Cabrera, finding on that occasion the lower jaws that were wanting to complete the ten skeletons, as well as various bones of different sorts, and fragments of other objects of archæological interest, which lay at a

little distance below the surface of the ground. This burial-place is on the slope of Ujana, and was unknown until its discovery in 1889. The entrance to it is obstructed by large stones, which must have been put there in very remote times. In the far end of the cavern fragmentary rubbish may be seen adhering to the roof, and it is more than probable that other human remains are hidden behind them.

There is no doubt that descendants of the tribes and families, to whom we have already alluded, are still to be found in Anaga, although they now bear different names from of old, for it is evident that when the natives were converted to Christianity after the Conquest, they changed their old names for Spanish ones in order to escape falling under suspicion of paganism or of treasonable practices, a thing that might readily have occurred at that time. This opinion is founded, not only on the purity of the indigenous type, which is preserved in Anaga to this very day, and on the traditions to which reference has already been made, but also on the extraordinary ideas or beliefs firmly rooted in the minds of the inhabitants of these valleys. To give a few instances of these, they hold that they live at "the very ends of the earth," a tradition which, even with the Guanches, must have had its origin in remote antiquity, for classical writers before the time of Augustus inform us that it was then a matter of common belief amongst the most ancient inhabitants of these islands; they regard death with horror, "because the body is buried in the ground, without having been first embalmed to preserve it from decomposition"; and, finally, they have as firm a belief in the apparition of the ghosts of the departed as any Eastern nation. In addition to this, we may likewise mention, in support of our opinion, several very peculiar customs belonging to the district, such as the habit, common to all the men, of wearing a *piel de fol* (goat-skin) bag, called a *cairamo*, on their shoulders; then, whenever any member of the family dies, the men let their beards grow as a sign of grief and mourning, as was also the custom of the ancient Romans. Neighbours in Anaga have always lent each other a helping hand in all the labours of the farm, a patriarchal mode of action that is still kept up; moreover, there is yet in existence, in certain parts, a legal procedure, one form of which evidently does not rest on the ordinances given by the Council of the island after the Conquest, or in the laws enacted at a later date for the advantage of the commonalty, but rather on the wise and humane customs of the indigenes that ruled the land before the *Megada* of the Spaniards. Lastly, it really seems as though the old Guanche spirit still animates these simple mountaineers, when we hear them enthusiastically relating the misty legends transmitted from the olden days regarding the different enclosures or historical sites already mentioned, or telling of scenes characteristic of the manners which have left ineffaceable traces in our recollection.

Right away down at the bottom of one of these wild valleys, we once suddenly heard in the distance a succession of whistles, and immediately looked up at the top of a high mountain whence the sounds appeared to proceed; there we perceived on the summit of the highest rock the profile of a man with a *cairamo* on his shoulders, who was making every

effort to call back the flock of goats of which he was in charge. After repeating the whistles, which sounded ever shriller and shriller in our ears, he began to come down from his point of vantage with an astonishing agility towards the level of the valley, balancing himself on outjutting points of rock that hardly seemed large enough to afford him foothold, aiding himself in his perilous descent by a long pole, and leaping the most prodigious distances, until after the lapse of but a few minutes he stood quite close to us, and not far from some goats which were feeding quietly, heedless of his calls. We looked with no little interest at the man, who saluted us respectfully. Immediately afterwards he turned his face away towards the mountain where he had left his flock, and putting two fingers into his mouth, pressing them between his teeth and his lips, gave utterance to a loud, sharp whistle: then, in order to call the *jairas* grazing near us, he said: *Ju-ri-qui, Tu-ri-qui, Torri-bomé, Chi-qui-to-mi*; and to chase others away he shouted: *Ju-rrio!' Jua-jay!' Jua-hay!.' Hu-pis!' Hu-pis!.' Chos-chis, Chios-chios!.'* The whole incident struck us with astonishment, and seemed at once to transport us into the midst of the old Guanche pastoral life, such as chroniclers living at the time of the Conquest have so often described.

Excursion to the Barranco de los Infiernos.

The people living at the Punta de Anaga have current amongst them a tradition, that many years ago an eel of enormous size lived in the Barranco de los Infiernos, a gorge situated in an out-of-the-way part of the same administrative district. According to the story this eel was a monster; its hideous head was covered with hair, and its eyes were always directed with a horrible intensity on those human beings who were sufficiently bold to approach the deep pool in which it lay. The creature inspired such terror in the breasts of the country people in the mountains around, that they called in the aid of the rector of the parish, alleging that it must be a demon in disguise, *with this result*—we are assured by tradition—*that the strong hand of the Inquisition was raised above the waters of the pool to exorcise the evil spirit, with such good effect that ever after they were extremely white in colour and had all the appearance of whey.*

The interest inspired by this curious tale was so great that we determined to visit the Barranco de los Infiernos, a place to which no traveller ever thinks of going, and which we had heard described as a very wild and rocky gorge. An expedition to this unknown and interesting spot was arranged in the summer of 1889. On the 25th of August we started from Casa Blanca (Roque Bermejo) at eleven o'clock in the morning, accompanied by the intelligent government official, Don Jacinto Lopez, keeper of the lighthouse at Anaga, and by certain worthy farmers, Juan Melián and Manuel Izquierdo, together with Juan de Sosa, who was provided with a pick, with which to remove any earth that might be in our way, or to cut steps for our feet wherever the steepness of the ascent made such precautions necessary. Half an hour after we had started we reached the shore close to the Paso del Jurado, a difficult place to cross, the time of our arrival not being at all suitable,

as we had made a mistake in our calculations, and the tide was too high to allow us to pass over dry-shod. We considered what was best to be done, for if we waited until the tide was sufficiently low we should be obliged to traverse the tortuous turns and winds of the *barranco* in the middle of the night. Suddenly a plan occurred to one of the men by which I might avoid the unpleasantness of an involuntary bath. He proposed that they should place themselves in a row, and that I should cross over by putting my feet on their shoulders and grasping the out-jutting rocks of the cliff. No sooner said than done, and I soon found myself happily landed on the other side of the Jurado without the discomfort of a wetting. A steep ascent now lay before us, and this we found sufficiently fatiguing, not only because of the severity of the climb, but also because it was necessary to cut steps in the hillside before we could gain firm enough foothold to enable us to ascend. The precipitous incline overhung a steep descent, at the bottom of which was the vine-land known as the Rincón. Although it now lay as in an abyss, three quarters of an hour earlier, when we crossed the shore, it appeared very high up above our heads. The ascent grew more and more difficult, and when we turned our eyes on the precipice below I could not help thinking of the traveller J. Leclercq, who, finding his colleagues of the French Alpine Club enjoying the excitement of a spice of danger, advised them to try going by the road from Taganana to Draguillo, a much less wild and adventurous undertaking than that on which we were then embarked.

From that dizzy height we went on in a south-easterly direction to another mountain where the gorge known as the Barranco de los Infiernos begins. Here we commenced our descent by a steep and abrupt pathway, and I confess that my interest momentarily increased with everything I saw in this extraordinary and hitherto unknown part of the country. The blackened rocks before us were absolutely devoid of verdure, and often very precipitous; they formed the walls of the *barranco*, whose intense solitude, combined with the sound of the loud clear echo produced by the concavities of the gorge, was startling. The lapping of the waves of the Caleta del Marrajo against the rocks (this Caleta is a kind of Stygian pool about which many legends are related, the very repetition of which inspires the listener with terror); the narrow horizon that grows ever narrower as we descend lower into the depths of the *barranco*; the sombre tones of the light, becoming gradually dimmer as the cliffs rise higher above us; the thought that this hidden gorge, whose name was marked on no map of the island, that had never been visited by either tourist or savant, might possibly conceal unknown historical treasures in some one or other of its unfrequented caverns; the surprise that would undoubtedly be depicted on the faces of my colleagues, and perhaps might even draw from some of them a broken remark on hearing of our approach to the alarming pool, as to whether the monstrous eel still inhabited its waters, or whether there were some obstacle to prevent any entrance into these diabolical regions—in fact, everything combined to enhance the lively interest I already felt in the expedition, and recalled to my remembrance the descriptions I had read in old German fairy tales,

and in Ovid's *Metamorphoses*, where he tells us of Perseus' return from Atlantis, after having conquered the daughters of Phorcus and a terrible sea-monster. At last we arrived at the bottom of the abyss, and scarcely had we gone a few steps farther than we discovered a cave, which was both dark and damp; inside, so close at hand that it was almost possible to touch them, wild pigeons' nests were built in fissures of the roof, showing clearly how very quiet and retired was the spot they had chosen. We rested there for a little; but knowing that the paths by which we had to go turned and twisted in tortuous and even dangerous windings for more than a league before reaching the Paso del Gamonal, the only exit by which we could leave the wild gorge, and that it would take several hours to walk the distance, we soon left the cave (to which, by the way, many legends are attached) and set out for the famous pool. It was not long before we reached it. It is situated right in the middle of the *barranco*, and consists of a large and deep pond of very transparent water; it fills its nearly circular basin to the brim, and the walls of rock surrounding it are formed of a hard yellow tufa, which no doubt gives the water its reddish-amber shade. The depth of the pool we found to be pretty considerable—several yards, in fact: its shape is that of an inverted cone with parallel grooves, which, thanks to the clearness of the water, show distinctly the indentures and outcrops of the tufa shimmering more or less red as the case may be. After having examined a few of the peculiarities of this curious pool we began our ascent of the other, or right-hand, side of the *barranco*. It was rather a difficult matter to climb out of the deep hollow, for the heat was excessive, and the rocky bank was very steep. The patch of sky, that had seemed no wider than 40° when seen from below, grew larger and larger as we ascended; the shadows vanished from the cliffs; the gloom passed away from the mouths of the caves, and also from the fissures in the rocks, until at last we reached a place where the light was diffused around. The pleasure we felt at that moment was only comparable to what one experiences in witnessing the growing light of dawn.

Having attained the summit, we stopped for a short time to contemplate the vast horizon spread out before us, and to enjoy a little rest after our exertions. Then we went on, turning to the left, until we came to a spacious cavern, which was formerly the abode of a certain *Achimencey* of Anaga, whence we had a splendid view over the country round. It was one of those bright, clear days in the heart of summer, when the Canarian sky is absolutely cloudless; the sun, scarcely below the zenith, shed its golden rays over the azure and pellucid waters of the ocean, which gave back a silvery and lustrous reflection in some parts, while in others, quite near the shore, it took a deep emerald or sapphire shade from the sea-weeds and mosses growing on the rocks, or from the reflection of the sky in the water. The view over the great expanse seemed unlimited, and far away in the distance we could distinguish the smoke of the steamers, which were hidden behind a promontory of Grand Canary as they entered the Puerto de la Luz; while nearer at hand we saw those which, going and coming, crossed each other in the bay of Santa Cruz opposite Antequera. An irregular chain

of mountains lay as it were at our feet, and jutted out into the sea, forming the promontory which Señor Vidal has marked in his map of Tenerife as the Punta del Drago, and beyond this again we saw the gentle ripple of the waves unruffled by any breeze. The tide was very low, so we were able to see a greater extent of the shore than would otherwise have been the case, and could distinguish a series of walls or dykes under the surface of the water, that were interlaced one with another at various angles, and showed clearly the ancient form of the land which had been submerged in the unknown past.

After an hour's rest we set out again in a north-westerly direction, following the path which we had crossed before. From this moment our route led us by a road flanking the sides of the narrow valley del Palmital, and our progress became much more rapid, for henceforth we only stopped in order to glance into a few caves, or to make a note of the names of the cliffs, etc., known to my companions, taking care to mark the highest hills and most interesting caves in the sketch I was making of the mountains and hollows we saw. At four in the afternoon we found ourselves on the Morro de los Cerrilleros, the highest mountain of the range, from whence, as far as the cliffs would permit, we followed a diagonal route in the direction of the Paso del Gamonal. It took us an hour and a quarter to do this stage of our journey, and, finally, when we arrived at the above-mentioned pass, which brought us out of the Palmital, we found ourselves in a place which has all the appearance of a great wall composed of immense blocks of stone piled up, and, as it were, flung upon a precipice. We now set to work to climb to the top, trusting more to our hands than our feet, and, having at length surmounted the difficulties and dangers of the ascent, we proceeded to the plain del Barro, whence we went on up the bed of the Barranco del Chamorga, and stopping for a time on the slopes of Granadilla, reached the village of the same name, where we had arranged that we should eat our dinner, at half-past six in the evening, thoroughly tired after our exertions and very agreeably impressed with all we had seen on this memorable excursion.

QUEENSLAND.

By J. P. Thomson, Hon. F.R.S.G.S.,

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(*Continued from page* 572.)

Natural Products.

Queensland is remarkably rich in products that flourish naturally under the congenial influence of a fine climate and soil. They are reliable indications of the geographical and geological conditions of the colony, as well as of the character of its climates and its soils. They

differ in some important particulars from the natural products of the southern portion of continental Australia, in that they include many distinctive tropical types, which are not met with in extra-tropical regions, nor in the alpine zones of higher latitudes. In fact, the flora of the country possesses many Asiatic forms, and this feature is strongly marked in the eastern tropical district, where numerous Indian types are distributed over a wide geographical range. The *Pandanus* tree, which ranges to New Guinea, the South Pacific Islands, and north to India, flourishes all along the Queensland coast, extending into the northern portion of New South Wales, where it intermingles with the vegetation of that country. The coastal fringe also includes in its vegetation other Indian types, the *Pandani* and the mangroves being, however, predominant, whilst the Asiatic forms still reveal their identity for some distance inland, where the leafy brushwood and cedar trees are met with. The Indian bamboo is rarely found in natural growth, but orchids are by no means uncommon in the rich tropical scrubs and forests of the north. It is, however, the prevailing *Eucalypti*, the *Acaciæ*, and other less pronounced forms peculiar to Australia, that give the vegetation of the colony its distinctive character. In favourable localities the dense scrubs of the eastern district of Queensland surpass all other natural products in luxuriance. They develop enormously in the moist heat and rich soils of the coastal region.

The vegetation of the country has yielded an abundant harvest; already the number of species discovered is remarkably large. The *Phanerogamia* comprise 1366 genera, 3752 species, 275 varieties, and over 200 naturalised plants; the *Cryptogamia* 449 genera, 1467 species, and 72 varieties. Although these include several plants that likewise flourish in India, the Malay Archipelago, and New Guinea, it may be remarked that no typical Australian plants are met with in India. This community of vegetation alone indicates that probably these countries were formerly united, and, furthermore, that the typical Australian plants were either developed after the separation of the country from Asia, or that there existed a distinctive Austral flora, distributed over a region whose limit did not extend farther north than, probably, the Equator.

The forests and scrubs yield a great variety of valuable timbers, eminently suitable for the capricious requirements of man. These are used extensively for cabinetmaking, shipbuilding, bridge-building, railway purposes, street-paving, house-building, and so forth. At the Melbourne Centennial International Exhibition of 1888 there were exhibited over five hundred varieties of Queensland wood, and it was estimated, by the Colonial Botanist, at the time, that these represented "probably little more than one-half of what might be collected in Queensland, . . . for no country in the world has a greater variety of useful and beautiful woods." The variety of grasses and economic plants, too, is not less remarkable. Of the three hundred and sixty kinds of Australian grasses, about three-fourths are met with in Queensland. Associated with these, in their natural growth, is an esculent herbage of highly nutritious quality, and it is doubtless owing to the natural commingling

of these diminutive forms of vegetation that the famous pastoral resources of the country are everywhere unsurpassed. Most of the grasses possess phenomenal vitality, and even when apparently annihilated by crushing droughts, they shoot forth luxuriantly after a shower of rain. The economic natural resources, although full of promise, have not yet been fully utilised. There has been little or no attempt to develop them effectively, and this is no doubt owing to the greater attention bestowed upon other more tempting industries. All kinds of tropical and extra-tropical fruits grow abundantly in the wild state and under cultivation. Vegetable oils of commerce are met with everywhere, and fibrous plants are numerous, many of the fibres manufactured from the latter being of excellent quality. About eighty varieties from the neighbourhood of Brisbane have been successfully treated by the late Mr. M'Pherson, who obtained the highest awards for them at international exhibitions in Australia and elsewhere. They are very fine in texture, and it would pay handsomely to establish an industry for their manufacture. There is a splendid opening in Queensland for the manufacture of vegetable oils, especially the essential oils of the *Eucalypti*, of which several varieties are met with. There are altogether about 360 known economic plants in the colony, of which some 130 have been introduced.

Animals.

The descent of many of the extinct animals of the *Nototherium* period is continued in the present one. The gigantic kangaroo, the native bear, opossum, native cat, dugong, dingo, lizards, alligators, and other species of prehistoric times, are fully represented by the smaller types of the present. Although it cannot be said that there are any very clearly defined faunal regions in Queensland, betwixt which approximate lines of demarcation could be established, yet there are, as a matter of fact, certain recognised zones contingent upon the climatic and physical conditions of the country, to which a limited number of animals are restricted. This is especially the case with the kangaroo, restricted in its range to the comparatively open downs country and to the thinly timbered coastal region south of Townsville: the cassowary, whose home is in the scrubs of the northern coastal district: the crocodiles, that inhabit the tropical rivers of the coast, and other less important forms of circumscribed geographical range. The remarkable Burnett salmon, known as *Ceratodus Forsteri*, is found nowhere outside the Burnett river. It belongs to the rare family of Dipnoids, the only other known species being met with in the Amazon and in Africa. The mammalian fauna is represented by many interesting animals, some of which are peculiar to Australia and New Guinea alone. This is especially the case with the various species of kangaroos, the sea-cow, *Halicore*, and two species of tree-kangaroos.

Birds are both numerous in species and beautiful in diversity of colour. The rich and dense tropical scrubs and luxuriantly thick forests of northern Queensland favour a much greater variety of bird life than is met with in any other part of Australia. Nowhere, except in New

ARROWROOT FIELD AT PIMPAMA

YEARLING DEVON BULLS AND LINCOLN RAMS AT CANNING DOWNS

Guinea and in the famous forests of Brazil, is the avifauna of the country surpassed, or equalled, in variety of species and in wealth of beauty. Several of these distinctive tropical forms possess many characteristic features peculiar to some of the Papuan birds of the Paradise family, particularly the *Manucodia*, *Chlamydodera*, and *Ptilorhis*. The cassowary of North Queensland finds a counterpart in the New Guinea species, and one of the kingfishers is common to both countries. Parrots and pigeons are abundantly represented in the whole of Australia, and they, too, are allied to the Papuan and Moluccan types. The remarkable mound-builders, the scrub turkey and northern scrub hen (*Megapodius tumulus*), are plentiful in many parts of the colony; the former is a bird peculiar to Australia; the latter is also met with in New Guinea and the Malay Archipelago.

Reptilian life is well sustained throughout the entire territorial area of the colony. It is one of the worst manifestations of Nature's creative energy with which man has to contend. Snakes, indeed, are numerous, and certainly inimical to the higher as well as to the lower forms of animal life. The decidedly venomous species are represented by several kinds, especially the death-adder, the black snake, the tiger snake, and the brown snake. The first is a harmless-looking, diminutive, inactive kind of reptile, but strikes with marvellous rapidity and force when disturbed. Considering the outdoor life of most of the colonists, in the forests, scrubs, and plains, the mortality from snake-bite is remarkably low. Many of the northern streams are infested with crocodiles, but these dangerous saurians are not found in the rivers of southern and western Queensland. The large crocodile attains a length of some 24 feet. It is stealthy in habit when seeking to seize its prey, and strikes with terrible and relentless force with jaws and tail as well. Queensland is rich in butterflies and other forms of insect life. Both *Ornithoptera* and *Coleoptera* are very plentiful, the rich tropical vegetation being especially favourable to the development of an apparently bewildering number of species and varieties. The rich colours are very beautiful and the size striking.

Climate.

The climate of Queensland has often been maligned, still oftener misrepresented, but rarely justly estimated. This chiefly arises from one of two causes—ignorance or prejudice. As a matter of fact, the climate of the southern portion of the colony is unrivalled. Extremes of temperature are unknown. The summer temperature is warm but rarely oppressively hot; in mountainous regions and on tablelands, of even moderate elevation, it is decidedly cool, temperate, and bracing. The winter climate of this part of the country resembles that of Naples. There is a prevailing cloudless sky, the atmosphere is clear, dry, and invigorating, the nights are comfortably cool, and the days delightfully warm. Frosts are very slight and of only a few hours' duration. This season is most conducive to health and congenial to outdoor life. Taken all round, it is, in fact, the nearest possible approach

to a perfect climate. The distressing hot winds, so frequently experienced in other southern colonies, are unknown here. The humidity is naturally greater in the coastal district than in the inland regions, where the air of the great western plains and rolling downs country is exceedingly dry and buoyant. The climate of the latter district is rapidly becoming famous for the beneficial influence it exercises upon those who suffer from pulmonary complaints and diseases of the throat. There seems to be no doubt whatever that several consumptive patients have been completely cured, and many greatly benefited, by its curative influence. In point of fact, this has been so fully recognised by the medical profession here, that steps are now being actually taken by the Government, through the Home Secretary, Honourable H. Tozer, to provide accommodation in the western towns for the proper and special treatment of consumptives. This enlightened policy on the part of the Ministry has been warmly supported by Mr. J. T. Bell, Member of Parliament for Dalby. From personal experience, I am bound to state that the favourable climatic conditions of Western, and even Southern, Queensland may often be underrated, but can scarcely be overestimated. In the tropical region of the colony the climate is naturally hot, but rarely oppressively so. The moist heat of the coastal belt is greatly modified by the refreshing sea-breezes and prevailing trade-winds. On the slopes and spurs of the Coast Range the temperature is comparatively low and the air clear and bracing, whilst the atmosphere of the Herberton tableland is remarkably salubrious, keen, and refreshing. Persistent and irritating miasmatic disorders are entirely unknown in this elevated region, where the nights are frequently cold and frosts by no means uncommon. West of the Coast Range the temperature is sometimes high during the summer months, but it is a dry heat, and very little inconvenience or discomfort is experienced by Europeans engaged in mining and other laborious occupations. Taken on the whole, it may be honestly stated that the climate of the country is highly favourable to the European constitution. It is exceptionally healthy throughout, and its influence decidedly beneficial. Epidemics and other kindred diseases inimical to human life are almost entirely unknown, and the rigorous and inhospitable climatic conditions of other countries never experienced. There is certainly an unequal distribution of rainfall over the country, and this is the reason why a systematic search for artesian water in the western district became necessary for the maintenance, as well as the further development, of the immense pastoral and agricultural industries of the colony. There is, indeed, an abundant annual precipitation over the coast districts, but west of the Main Range the rain is scanty and uncertain, and this unhappily occurs in a region where the loss by rapid evaporation is astonishingly great. The mean annual rainfall at Cape York is over 60 inches, at Cooktown 74 inches, at Geraldton 156 inches, Mackay 72 inches, Brisbane 51 inches, and at Nerang 75 inches. The heavy rainfall of the Cardwell and Mackay districts is very striking. There appears to be a tropical belt there, between the parallels of 16 degrees and 22 degrees, where the closely packed isohyetic lines on the rainfall map indicate an abnormal precipitation. This, however, is

STOCKYARD

purely coastal in range, very little ever reaching far back into the interior. Queensland is thus partitioned into two distinct and well-defined pluvial zones, that correspond with the dominating climatic ones in a very marked degree. The eastern or coastal division is abundantly watered by a copious rainfall; the vegetation is in consequence luxuriant and the soils exceedingly fertile. In the western district the mean annual rainfall is generally scanty, and not infrequently deficient in places. It gradually diminishes from about 47 inches at Toowoomba, on the top of the Main Range, to about six inches at Birdsville; and at Camooweal, within the tropics, and almost due north from the latter place, it is about 15 inches only. The natural effect of this minimum precipitation is everywhere felt in the extreme dryness of the climate, and this would indeed have rendered the pastoral occupation of some far west and remote areas altogether impracticable were it not for the valuable artesian waters with which this part of the country is now abundantly supplied. Since artesian water was first discovered in the storage beds of the Lower Cretaceous formation, which is estimated to represent 56 per cent. of the entire area of the colony, the borer's drill has pierced the rolling downs strata in all directions. Wells have been sunk at the expense of a liberal and enlightened Government, as well as by private enterprise. The result has been a complete transformation of the country from its former dry and parched state to a happy condition of fertility. There are now some 454 bored wells in western Queensland; these average 1168 feet in depth, the aggregate number of feet bored being 530,332 (100 miles); 317 of these bores overflow, their aggregate output being about 193,137,200 gallons daily. There are 19 additional deep bores east of the coast range whose aggregate depth is about 13,200 feet. The total value of the artesian bores of the colony is estimated at £928,081. There are several of the bores whose daily yield is from three to four millions of gallons apiece, and much of the water is suitable for irrigation purposes. Besides the bores, there are numerous natural artesian springs that yield a very large supply of good water, and these appear to occupy a belt of country between which and the central region of the continent there is probably some well-established connection, as they correspond in their peculiar characteristics with the thermal springs observed by travellers in that part of the country.

The temperature records of the colony are now well established. They very clearly indicate by their maximum and minimum isothermic lines that the heat is very rarely abnormal in any part; that there is, in point of fact, an agreeable uniformity in the thermometric range throughout the year. At Brisbane the mean shade temperature is 68 degrees, at Roma 65 degrees, Rockhampton 72 degrees, Townsville 75 degrees, and at Hughenden 74 degrees. The high shade temperatures of from 115 degrees to over 120 degrees, sometimes recorded in neighbouring colonies, are not experienced in Queensland, where these abnormal heat-waves so dangerous to animal life are never developed. The wet season occurs in the months of December, January, and February, during which time thunder showers are frequently experienced, and the rivers sometimes flooded.

Industries.

There is no doubt whatever, that as a wealth-producing colony, Queensland occupies a position in the front ranks of the British Empire. Its youthfulness, and the inexperience usually associated with that period of life, have done nothing more than combine to retard its progress, but the influence of these opposing elements has been far less keenly felt than in other countries even more favourably circumstanced. Viewed from a national or territorial standpoint, the population of the colony is absurdly small. It is indeed obvious that the full development of the great revenue-producing resources cannot be accomplished by the 460,550 people that now inhabit the country, the majority of whom are urban dwellers. It is only by the substantial increase of the rural population that the latent wealth can be rendered productive. The small number of colonists may, however, refer with pardonable pride to the annual export trade, that now amounts to £8,982,600, being about £19, 10s. per head. No other country can show a higher record, and no more satisfactory evidence can be given of the industry and enterprise of the people, who are loyally endeavouring to extend the British Empire in this fair land. The industrial resources of Queensland have drawn to its shores people of divers nationalities, who contribute to their development. Besides Britishers and other Europeans, there are Americans, Chinese, Japanese, Indians, Servians, and Polynesians. The Pacific Islanders, or Kanakas as they are commonly called, are chiefly employed as labourers in the sugar industry, for which occupation they are eminently suited. There has been a good deal of opposition, by a certain class, to their introduction, but it is considered by the employers that they are better fitted for work in the tropical cane-field than Europeans. As a rule they are a well-conditioned class of people, and their habits are less objectionable than the ways of many other classes who have enjoyed the advantages of civilised life. They readily adapt themselves to the greatly altered conditions of civilisation, which they soon learn to appreciate, and the considerable numbers of time-expired labourers who return to the colony, after having visited their island homes, bear ample testimony in favour of the traffic. Most of them leave Queensland with a well-stocked wardrobe, and a good banking account, too. From the writer's own prolonged experience in Polynesia and of the Polynesian labourer, it may at once be said, without hesitation, that the system of immigration, as now conducted, exercises a decidedly beneficial influence upon these people, in every respect. They are introduced into the colony under strict Government supervision, and irregularities of any kind are not tolerated.

The public debt, now amounting to some £31,873,934, is really comparatively small for a colony whose immense resources and natural wealth are beyond estimation. The great public railways, constructed at a cost of £18,743,000, are in the hands of the State. Besides this latter amount, large sums of the debt have been spent in reproductive works, and some £3,000,000 on immigration. Nominally the interest on the debt is about £1,256,581, and no doubt this will ere long be

greatly reduced under the able administration of the present enlightened Ministry, of which Sir Hugh Nelson is the distinguished head. It must, however, be borne in mind, that, even now, the actual interest is very much less. The cost of administration is small, and great economy is practised in every department of the State. In this respect it is a pleasure to note that the excess of revenue over expenditure for the year 1895-96 was £73,636. Notwithstanding its diminutive and greatly scattered population and undeveloped resources, Queensland stands third on the list of Australian revenue-producing colonies. There is no doubt whatever that the present revenue of £3,641,583, for 1895-96, could be doubled within a very few years if once the known gold-fields were more fully developed and other industries established. Although some 2400 miles of railways are now opened for traffic, and several new lines are about to be constructed, it must be admitted that these great arteries of commerce will have to be still farther extended over the country as territorial settlement increases. It will, no doubt, be found necessary to tap the northern portion of the colony by a grand trunk-line of railway, extending to the shores of the Gulf of Carpentaria. This would place the capital city of Brisbane greatly nearer in time with London and the East, and, moreover, contribute in no small degree to the opening up of the more remote parts of the country itself. Even now, the Great Southern Railway connects Brisbane with Sydney, Melbourne, and Adelaide on the south; Gympie, Maryborough, and Bundaberg on the north, and Dalby, Roma, and Charleville in the far west, are also reached by rail from the capital city of the colony. In the central and northern districts, the great pastoral areas of the west are pierced by the iron roads that connect the remote township of Longreach, on the Thomson River, with the important seaport town of Rockhampton; and Hughenden, on the head-waters of the Flinders river, with Townsville. Hence the formerly lonely dwellers on the banks of the far western rivers are no longer cut off from the intellectual and social life of the coastal settlements. The old-time bullock-wagon and passenger coach have been forced to give place to the iron horse, and, besides the cracking of the stockman's whip and prancing of hoofs, the stillness of the vast downs is now broken by the shrill screeching of the steam whistle and snorting of powerful locomotives, that dash along to and fro in obedience to the will of inventive man.

The principal products of the colony are derived from three great primary sources—pastoral, mineral, and agricultural. The first of these is more fully developed than the others. It was, in fact, the parent industry, the foundation of which was laid by the early pioneers, who pushed northwards with flocks and herds from the mother-colony, in search of fresh pastures. It is, in truth, the "squatter" to whom we are very largely indebted for opening the country to settlement and colonisation, although the obligation is not always so fully acknowledged as it ought to be. There is no doubt, however, that much of our knowledge of the geographical conditions of Queensland, and indeed of the whole of Australia itself, has been derived from this tardily and inadequately recognised source.

In the early days even it was well known that the vegetation and climate of the great western district are eminently suitable for stock-raising, and large areas are now occupied for this purpose. Although cattle and sheep have been, and are now to some extent, pastured on the lands of the coastal region, the number is small compared with the great flocks and herds that flourish, and are still rapidly increasing, on the famous pastoral lands of the rolling downs. It is, however, anticipated, that instead of being mostly used for grazing purposes, the rich and fertile lands of the Darling downs will in future be utilised for the production of grain, for which they are unrivalled.

There are altogether about twenty millions of sheep, seven millions of cattle, and five thousand horses in Queensland. The wool finds a place in the world's markets, the value of this product alone being £3,000,000 for the year 1895. The return from meat for the same period was close upon £1,000,000; from hides and skins, £456,500; and from tallow, about £600,000. Altogether the revenue derived from the pastoral source itself was over £5,000,000 for the year under review. The further development of this already gigantic industry is greatly hindered by the difficulty experienced in readily placing the beef and mutton upon the European market. Both of these products are acknowledged to be of excellent quality; the supply is practically inexhaustible, and the cost very low. There is no reason whatever why the meat consumers of the United Kingdom should not obtain their supply from Queensland, and the same may be said of India and Japan. The question of transport is one that need no longer render this impracticable, since the ordinary passage to England is now so comparatively short that weekly supplies may be landed in London with unfailing regularity. Extensive meat-works, it is true, have been established in the colony at very great cost, and large steamers have carried away many cargoes of frozen meat, but the industry needs further encouragement before adequate development can be accomplished. This would not be long wanting were the very fine qualities of the meat fully appreciated. A mistaken preference has already too long been shown in favour of the meat-supply of other countries, but this is owing to unjustifiable prejudice rather than the existence of actual cause.

The agricultural industry is limited to the eastern settled district, from Cooktown south. There is a broad coastal belt, south of the twenty-second parallel, highly favourable to the cultivation of maize; the rainfall is more than twenty inches during the summer months, which is the rainy season there, and the soils are exceedingly fertile. Since the discovery of large supplies of artesian water, extensive areas of country have thereby been rendered suitable for agriculture that were formerly of no value for that purpose. This is especially the case with the rich pastoral lands of the west, to which I have already alluded, where the climate and soil render them of immense value for the production of grain. It is no exaggeration whatever to state that in no other part of the world—and this cannot be too often reiterated—has nature provided a more suitable region for the grain cultivator, than the one under consideration. The whole of the agricultural farms in the colony represent

COOKTOWN

an aggregate area of about 2800 square miles; some 588 square miles are under cultivation, including an area of 120 square miles under sugar-cane. The sugar industry is one of very great importance, and its bearing upon the present and future prosperity of the country can scarcely be overestimated. The sugar lands at present under cultivation chiefly comprise the rich alluvial areas of the coastal region, especially in the Mackay and Bundaberg districts, where large mills with elaborate appliances have been established at very great cost. The estimated output of sugar for 1896 was 100,000 tons, valued at £1,000,000. It will thus be clearly enough seen that the total extinction of this national industry would inflict incalculable injury upon the country.

Land in Queensland may be easily and readily acquired from the Government on terms and in areas liberal enough to place it within the reach of all. Every colonist may be the holder in fee-simple of a farm, either for grazing or agriculture, and there are at present very large areas available for selection at prices of from 15s. to 20s. per acre.

Tobacco grows to perfection in the Stanthorpe and Killarney districts, and it is locally manufactured to some extent, the quality and flavour of the weed being greatly appreciated by consumers. Coffee is cultivated in the northern district, east of the Main Range, where the soil and the climate are especially favourable to the growth of the plant. Cotton and arrowroot find congenial fields in the rich lands of the southern district, on the eastern side of the Main Range. The former product is also raised at Ingham, in the northern district, where the local conditions are eminently suitable to its perfect development. Fruit-growing is an industry that has hitherto received very little attention, although the local demand has but too often been supplied by the markets outside the colony. It very often happens that agriculturists start fruit-growing without the experience necessary to success. The inevitable result is failure, with much loss of time and means. The future is, however, more hopeful, since the State has appointed an expert, who will impart instruction in growing and preserving. There is a great scope in Queensland for the further extention and development of the fruit industry. The delicious and luscious fruits which attain perfection in the northern districts, within the tropical zone, are represented by such well-known forms as the mango, the custard-apple, the date-plum, the mangosteen, the pine-apple, and the banana, besides many others. The good old types of the temperate zone, so familiar to the British eye and palate, find congenial soils in the southern division, where they grow to perfection in the cool and bracing region of Stanthorpe and the neighbouring country. Delicious grapes of very many varieties are sent to the Brisbane market from Roma and the East Moreton districts. They are rich in flavour, excellent in quality, and very cheap.

The ramifications of the pearl-shell industry extend over the numerous shallow submarine areas of Torres Strait, within the Great Barrier Reef. Thursday Island is the capital of the pearl fleet, and it is also the neutral camping-ground of a mixed population from all quarters of the globe, who are mostly engaged in pearl-shelling. The

employment is not always unattended with danger to life, and cases are sometimes recorded of divers who, tempted by the prospect of a rich field, have incautiously dived at greater depths than prudent. In such cases they have paid the penalty with loss of life—a penalty relentlessly exacted without distinction. The industry is an important one to the colony, and special legislative measures have had to be enacted for its proper regulation. Over 878 tons of pearl-shell were exported during the year 1895, valued at about £72,000. This sum does not include the amount realised for the many valuable pearls that have been found in the shells. Divers are employed to search for the pearl-shell in depths up to twenty fathoms. The great danger lies in exceeding this limit of safety.

To the enterprising colonist, Queensland offers a very wide field for the establishment of industries, or for the further development of existing ones. To capitalists there are various channels for the ready circulation of capital and for its profitable investment. Many of the gold-fields only require the judicious investment of capital to develop them into profitable and permanent industries, that would yield very handsome returns. It is, indeed, well known to the officials of the Government, who are competent to express authoritative opinion upon the subject, that rich mineral areas exist in several gold-fields that have been temporarily abandoned in favour of more tempting ones, where gold is supposed to be easily found at a minimum cost. The meat industry is yet in the experimental stage, so to speak, and to its future possibilities there is practically no limit. No systematic steps have yet been taken to supply the local markets with fish, although the coastal waters teem with fish of excellent quality. The agricultural industry and its associated branches offer an unlimited field for the profitable investment of small capital and the remunerative employment of agriculturists with very moderate means and practical experience. Irrigation has only yet been attempted on a very small scale, operations being chiefly confined to the lands of the lower Burdekin basin. The artificial watering of the lands will no doubt receive early attention in the western parts of the colony, now that artesian supplies of water have been obtained in country where formerly irrigation was impracticable. It is not possible to give even an approximate estimate of the areas of lands suitable for irrigating, but, broadly speaking, it may be said that probably the whole, or most, of the vast rolling downs country is naturally adapted for that purpose.

Towns.

Brisbane, the capital city of the colony, is situated on the banks of the Brisbane river, about twenty miles from the mouth. The city is built on both sides of the noble stream, which is here spanned by a magnificent iron bridge, recently constructed in place of the one destroyed by the great flood of 1893. Many very fine public buildings and business houses have been erected on both sides of the river, and the terraces and hillsides are everywhere dotted over with residential

BRISBANE

structures, built to meet the requirements of a congenial climate. Public gardens and recreation parks have been provided for the benefit of citizens and visitors, who have free access to them at all reasonable times, and the city is traversed by many fine streets. It is the terminus of the Southern and Western and North Coast Railways, and a well-regulated telegraph service provides speedy communication with all parts of the world. The Enoggera and Gold Creek reservoirs furnish an ample water-supply, and most of the principal buildings are illuminated by the electric light. Tramways, omnibuses, and cabs move in all directions with living freight, and a well-organised corps of municipal inspectors regulate the surging traffic. The citizens are an exceptionally well-conducted and orderly class of people, and few other great centres of population can compare with Brisbane in this respect. In fact, the residents, as a whole, are so loyal and law-abiding, that no peace-disturbing element is permitted to intrude. The morning and afternoon Press supplies all the news of the day from the Equator to the Poles of the Earth, and in no other part of the world is greater attention and space devoted to scientific, educational, and other intellectual subjects than in the city newspapers. In this respect, the Press here compares favourably with that of other countries, no subject being overlooked that is at all likely to contribute to the elevation of the public mind.

At the close of 1896 the population of Brisbane and suburbs was estimated to be 100,913.

The principal coastal towns, north of Brisbane, have already been enumerated. Briefly, then, they comprise the well-established and thriving centres of Maryborough, Bundaberg, Rockhampton, Townsville, and Cooktown. Besides these, there are several towns along the coast-line where commercial and industrial pursuits are rapidly increasing in importance. The chief inland centres of the southern district are represented by the flourishing pastoral towns of Toowoomba, Warwick, Stanthorpe, Dalby, Roma, and Charleville, and by the important town of Ipswich. In the central division of the colony the towns of Barcaldine, Springsure, and Clermont occupy positions in the midst of important pastoral districts, on the main railway line, and this remark also applies to the town of Hughenden, farther north.

In concluding this paper, prepared by special request of the Royal Scottish Geographical Society, I must acknowledge my obligations to the Queensland Government for material assistance. My thanks are especially due to the Prime Minister, Sir Hugh Nelson, to the Minister for Public Lands, Hon. J. F. G. Foxton, and the Attorney-General, Hon. T. J. Byrne.

A great deal more could have been said of Queensland, but already the ordinary limit of space has been exceeded; for which trespass the importance of the subject will, I trust, be accepted as a sufficient excuse.

THE SURFACE CURRENTS OF THE NORTH SEA.

By T. Wemyss Fulton, M.D., F.R.S.E., Scientific Superintendent, Fishery Board for Scotland.

(*With Map.*)

In recent years the hydrography of the North Sea has been made the subject of careful investigations by a number of observers, particularly with respect to the movements of its waters. The distinguished Swedish scientists who have taken the leading part in this work have succeeded in throwing a great deal of light on the physical changes and movements which occur at different seasons in the waters of the Kattegat, Skagerrack and adjoining areas;[1] and the results have quite recently been brought into relationship with the fluctuations which take place from year to year in the produce of the herring fishery.[2]

In connection with certain fishery problems experiments were begun a few years ago by the Fishery Board for Scotland with the view of ascertaining the course and speed of the surface currents off the east coast of Scotland. These experiments have now been completed,[3] and I propose to give here a summarised account of the results. The most important object of the experiments, from a practical point of view, was to ascertain the part played by the surface currents in transporting the floating or pelagic eggs and larvæ of marine fishes. It is now well known that the eggs of all the food fishes, with the exception of the herring, skates, and rays, and a few unimportant species, are buoyant, and float as tiny, isolated spheres of glassy transparency, dispersed throughout the surface waters. This is so, for example, with the eggs of the cod, haddock, whiting, ling, etc., and all the flatfishes; and as the development of the embryos within the eggs may take in some cases several weeks, according to the species and the temperature of the water, during which time the egg is floating about in the sea, it is clear that they may be carried considerable distances before hatching occurs and the young fish escape. Further, the larvæ fish is very small and comparatively feeble, and it also may be carried a long distance by the current before it has grown sufficiently strong to contend against it.

It has also been proved that almost all the food fishes, certainly all the important ones, do not shed their eggs near the shore, within the three-mile limit, on the east coast, but farther off, and probably in many cases up to a considerable distance from the coast.[4] If these pelagic eggs, which float about for so many days or weeks exposed to the

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[1] *Vide* Professor Pettersson's elaborate papers in the tenth volume of this journal.

[2] *Skageracks Tillstånd under den nuvarande Sillfiskeperioden*, af P. T. Cleve, G. Ekman, J. Hjort, O. Pettersson, Göteborg, 1897.

[3] *Fifteenth Annual Report of the Fishery Board for Scotland*, Part iii. p. 334.

[4] "The Spawning and Spawning-Places of Marine Food Fishes," T. W. Fulton, Part iii. *Eighth Annual Report of the Fishery Board for Scotland*, p. 257.

vicissitudes of the sea and weather, were to be shed near the shore, multitudes would be stranded and lost. The chief object of the experiments, then, was to ascertain the existence, direction, rate, and constancy of the surface currents over the great spawning areas off the east coast, so as to determine the biological relationship between these areas and any given stretch of the territorial seas. Do, then, great offshore spawning-grounds supply young fishes to the inshore waters opposite to them, or

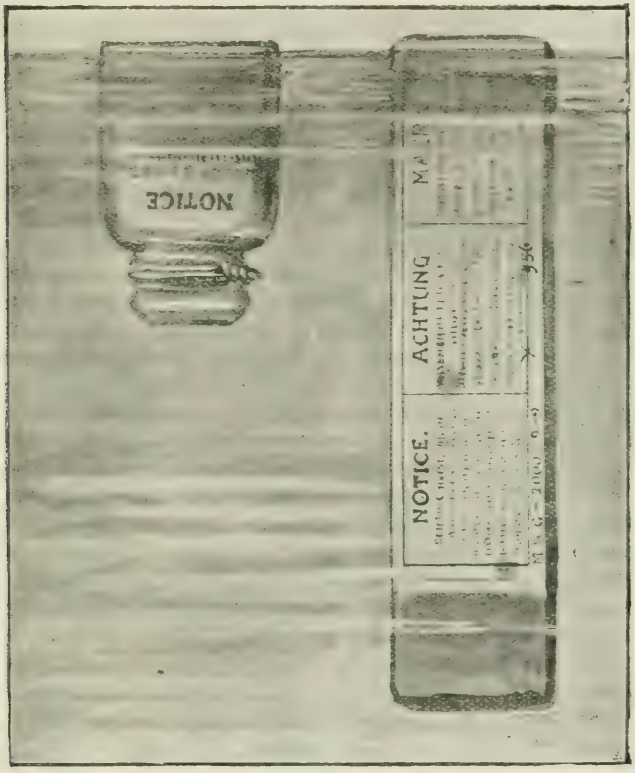


FIG. 1.—The Floats.

to those at a distance? Is there any fairly constant connection between them?

The method employed in the experiments was to throw into the sea, off various parts of the coast, a large number of floats or drifters, each having a number for its identification when recovered. This mode of ascertaining the direction of surface currents has been frequently made use of, as, for instance, by the U.S. Hydrographic Department, the Deutsche Seewarte, and the Prince of Monaco. Two kinds of floats were used, one-ounce wide-mouthed bottles of coarse glass, and strips of wood six inches in length by an inch in breadth. A printed card with

directions in English, German, and Danish was put inside the bottle, or tacked to the strip of wood, and the whole was rendered impervious to water by the use of melted paraffin-wax, the layer over the card attached to the wooden slip being transparent enough for the print to be read through it. As it is of importance in such experiments to have the floats almost submerged, in order to eliminate as far as possible the direct action of the wind on them, each float was carefully tested in sea-water, and was so weighted with lead wire or sheet-lead that it floated upright in the water and nearly submerged (Fig. 1). The results showed that the bottles were much more reliable than the wooden slips.

The experiments were begun in September 1894, and were continued until the spring of the present year. During that time the number of floats set adrift in the North Sea, or to the west of the Orkney and Shetland Isles, was 3553 (2074 bottles and 1479 wooden slips), and the number returned to me, up to March last, was 502.[1] From three or four to twenty or thirty floats were thrown overboard at the same time and place, most of them from the Fishery Board's steamer *Garland*, others from fishing boats, and from steamers sailing from Leith to Christiansand, Hamburg, and Rotterdam, and to the Orkneys and Shetlands. A number were also set adrift from H.M.S. *Research* between the Shetland and Faeröe Isles. The area therefore in which they were put into the sea was considerable, extending from the last-named islands down the east coast, as well as along the various steamer routes indicated on the chart. The floats recovered were found on the eastern side of Britain from the Orkneys and Shetlands, in the north, to Norfolk, in the south, and on the coasts of Holland, Germany, Denmark, Sweden, and Norway, where some were picked up north of the Lofoden Islands, within the Arctic Circle: they were thus scattered along nearly 2000 miles of coast.

From a study of the data relating to the floats recovered it has been shown that the normal course of the surface currents in the North Sea is southwards along the east coasts of Scotland and of England, as far as the neighbourhood of the Wash; it is then eastwards towards the coast of Denmark, and then northwards along the west coast of Norway; sometimes it enters the Skagerrack, floats having been stranded on the west coast of Sweden, the south coast of Norway, and on the shores of the Christiania Fjord.

In the northern area the floats which were put into the sea in the Faeröe-Shetland Channel, west of the Shetlands and Orkneys, and at various places in the neighbourhood of these islands, moved eastwards and southwards, as represented in the adjoining chart (Fig. 2). While most of those set adrift far to the west of the Shetlands were picked up on those islands, some of them were found on the north-west coast of Norway. Thus one, from lat. 60° 38¼′ N., long. 5° 35½′ W., was found at Sörsmölen, near Christiansund, having travelled about 430 miles in 204 days. Others, from lat. 60° 2′ N., long. 7° 4′ W., were found in S. and N. Trondhjem, as far as 700 miles distant. In the southern part of the region the course of the floats was towards the south-east and south,

[1] About 70 others have since been returned.

and this was very obvious off the Moray Firth. The results show that the surface water passes from the Atlantic, in the neighbourhood of the

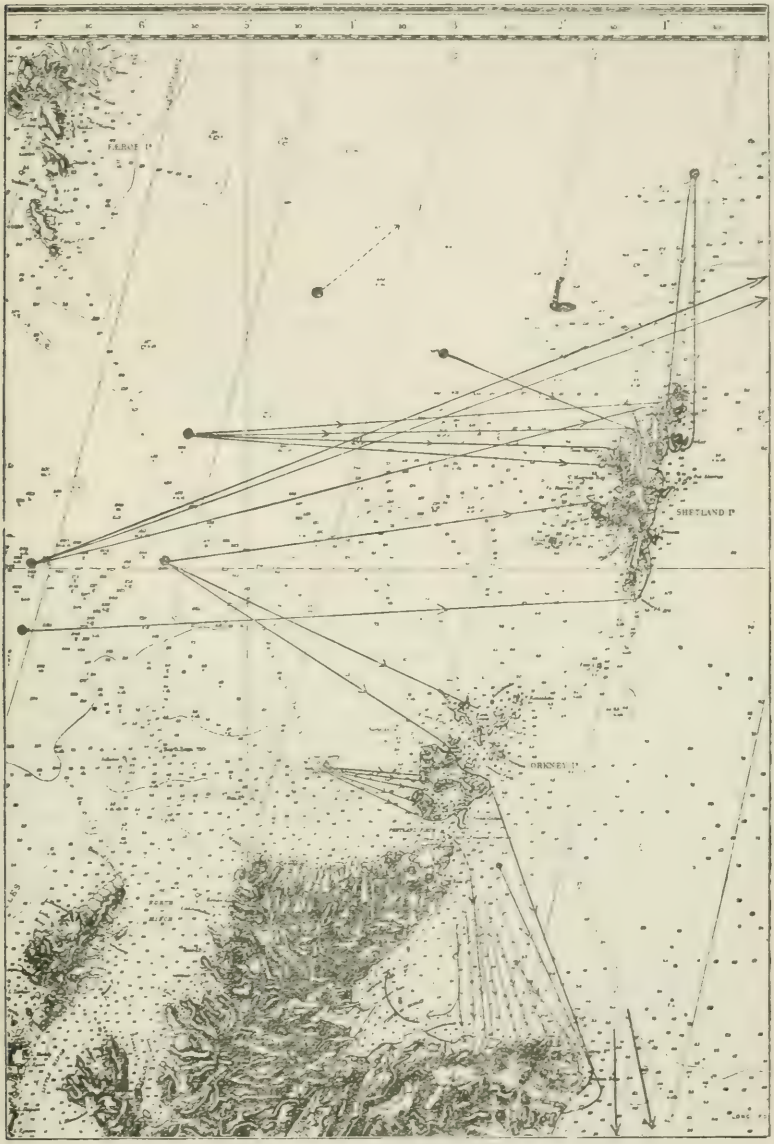


Fig. 2.—Floats in the Faeröe-Shetland Channel.

Orkney Islands, and moves southwards along the east coast. In the Moray Firth it was found that the great majority of the floats put into the sea to the east of a line drawn from Duncansby Head to the mouth

of the river Spey—parallel to the 3° of west longitude—were stranded on the north coast of Banff and Aberdeen, while those set adrift to the west of this line moved, as a rule, westwards, and then up along the coast of Sutherland and Caithness in a northerly direction. Thus, of fifty-nine set adrift to the west of the line mentioned, fifty-four were found within that line; of seventy-one set adrift to the east of the line, only two were found to the westward of it. It is clear from this statement that the general movement of the surface water, from off Duncansby Head, is southwards. It impinges on the south coast of the Moray Firth east of the Spey, and the great mass is then deflected eastwards.

On the east coast of Scotland, south of the Moray Firth, almost all the floats moved southwards, at all seasons of the year, as shown in the following table:—

I. *Found to the South*—		II. *Found on Continent*—	
1. On Scotch coast,	58	1. In Norway,	15
2. At sea off Scotch coast,	2	2. In Sweden,	1
3. On English coast,	0	3. In Denmark,	35
Northumberland,	20	4. In Germany,	4
Durham,	10	5. In Holland,	5
Yorkshire,	26		—
Lincolnshire,	2		60
Norfolk,	0		
	—	III. *Found to the North*,[1]	21
	58		
4. At sea off English coast,	1		
	119		

Two things stand out conspicuously in the above table. The first is, that the floats stranded on the English coasts were stranded on the northern part. Only two were found in Lincolnshire, and none at all (of those set adrift on the east coast) on the coast of Norfolk. Thus, none was stranded south of the Wash, only two between the Wash and the Humber, and the great majority to the north of Flamborough Head. The second point is that, compared with the Moray Firth floats, a great number were stranded on the coast of Denmark, and comparatively few in Norway, while some were found on the coast of Holland and Germany. The great majority of those found on the coast of Scotland were stranded on the shores of Fife and East Lothian, some were found on the Isle of May, and others on the coast of Berwickshire. Only two were picked up on the coast of Forfarshire, and none in Kincardineshire or Aberdeenshire. They were, therefore, stranded, just as in the Moray Firth, on those parts of the coast which front the north. A considerable number were set adrift near the Bell Rock Lighthouse, and they were found mostly on the Scotch coast to the south, but some landed on the English coast; of others, put farther out at sea in the same area, the majority were found on the coast of England, and others on continental coasts.

The floats, which were found on the other side of the North Sea, moved, first of all, southwards along the east coast of England. This is shown by a large number of cases in which some of the same lot, set

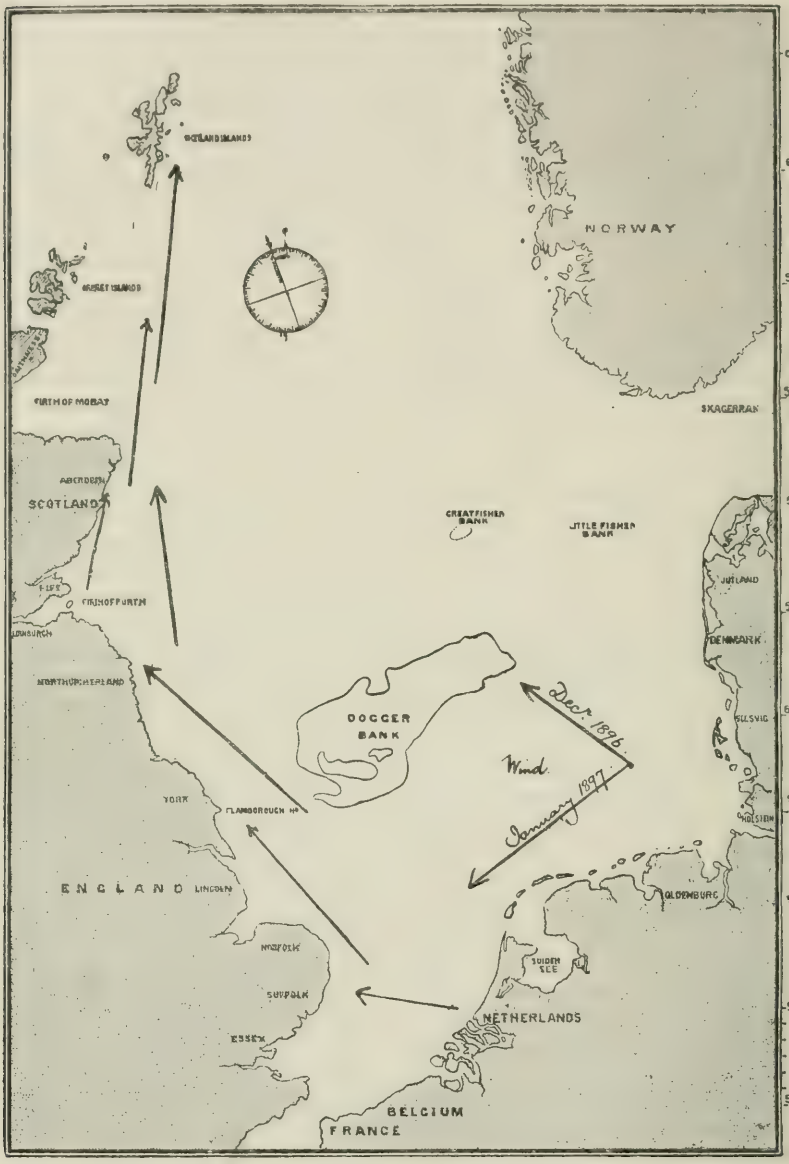
[1] These comprise those carried north by the reversed current (see p. 643) and some set adrift close to the shore.

adrift together, were found on the English coast, while others were picked up later on the coasts of Holland, Germany, and Denmark, and, later still, on the Swedish or Norwegian coast. For example, on 20th March 1895 ten bottles were set adrift near the Firth of Forth; on the 2nd April, thirteen days later, two were found on the coast of Northumberland, about 67 miles distant; two days afterwards, on the 4th April, another was found 82 miles distant, also on the coast of Northumberland; on the 20th May, after 61 days, a fourth was found near Spurn Point, Yorkshire, a distance of 202 miles; on 1st August, after an interval of 134 days, a fifth was picked up three miles north of Blokhus, Denmark; and on 14th September a sixth, two miles north of Ringkjöbing, Denmark. It was also found that the course of the floats, thrown into the sea along the steamer routes, indicated the same southward movement of the surface water on this side of the North Sea, and a northward movement on the other side; but the dividing zone between these two areas of movement was found to shift at different times. Usually the floats put in on the Christiansand route, within 150 miles of the Scottish coast, passed south, and many were found on the coast of Denmark; those set adrift within 50 or 100 miles of the Naze moved northwards along the coast of Norway. On the route to Hamburg the same thing occurred. Floats put in on the western part were found to the south, on the coast of England. In some cases, where they were set adrift 150 and 200 miles SE. by E. of the Isle of May, they were found on the south-west coast of Norway. Those thrown in towards the other side were picked up to the north, on the coast of Denmark, in the Christiania Fjord, on the coast of Sweden, or the south coast of Norway.

The southward movement of the surface water along the east coasts of Scotland and England appears to be continuous at all seasons, for the floats, with an exception to be presently alluded to, were always carried in this direction. None of the bottles or slips was found south of Norfolk on our side of the North Sea, or south of the Helder on the other side; and these facts may be taken as showing that none of the surface water, passing down the east coast, escapes by the Straits of Dover. It appears to be all deflected towards the Continent in the neighbourhood of the Wash. The rate of the movement was found to vary very considerably according to the direction and force of the wind. With a strong wind behind, blowing in the same direction, the floats travelled about ten or twelve miles (knots) a day. The average rate, over long distances, was between two and three miles in the twenty-four hours.

With respect to the causes which produce this circulation of surface water in the North Sea a study was made of the direction and force of the winds, as shown by the daily meteorological observations at a number of Scottish, English, and continental stations. It was found that the prevailing wind at North Unst blew from WSW. $\frac{1}{2}$ S. in 1895, and from WSW. in 1896; at Buchan Ness it blew from W. by S. $\frac{1}{4}$ S. in 1895, and from SW. by W. in 1896; and at the Bell Rock from W. by N. $\frac{1}{4}$ W. in 1895, and from W. by N. in 1896. The direction of the prevailing or effective winds at these three stations is indicated on the chart, and it will be observed that they blow at right angles to the course of the

current along the east coast. It is clear from these facts that the movement of the floats on the east coast of Scotland was not directly and



—Showing the Reversal of the Current.

immediately due to the action of the prevailing winds; it is also clear that they are not, as has been sometimes contended, driven by the wind

independently of the movement of the water in which they are suspended. If they, or the surface water, were merely driven before the wind from the east coast of Scotland, the general course would be north-east and easterly, whereas we have seen that the almost invariable course is southerly, at right angles to the direction of the prevailing wind. That is, I think, an important point to establish.

That the wind, however, has a most important influence on the movement of the surface waters was shown by a very remarkable reversal of the current in December 1896, and January of this year. Floats were returned to me from parts of the east coast lying to the north of the places where they were set adrift. This occurrence was so unusual that at first I thought a mistake had been made in recording their numbers, but it was soon apparent that this was not the explanation, and that, in reality, the surface water was moving rapidly northwards along the whole east coast from Norfolk to the Shetlands, as shown in Fig. 3. Some of the floats returned belonged to groups which had been put in a considerable time before, numbers of which had been previously picked up to the south as usual, and they were, no doubt, well on their way to the Continent when the reversal took place. Some were set adrift in December and January off the east coast of Scotland and England, and they rapidly moved northwards. Others, which were thrown into the sea near the Hook of Holland, travelled westwards, and were stranded in large numbers on the coast of Norfolk. On examining the wind observations it was found that the prevailing winds in December blew from a southerly and easterly direction, and in January from the east and north-east, as follows:—

	N. Unst.	Buchan Ness.	Bell Rock.	Shields.	Yarmouth.	Helder.	Skaw.
Dec. 1896,	S. ¾ E. 36	SE. by S. ½ E. 29	S. by W. 8·3	SE. by E. ½ S. 9·3	SE. ½ E. 19·5	WSW. ½ W. 4	S. 2
Jan. 1897,	SE. ¼ E. 12	ENE. 19·7	E. 13·5	NE. by N. ½ E. 22	ENE. 10·5	E. by S. ½ E. 20·75	NNE. ½ E. 9·75

It was also found that strong winds and gales from south, south-east, east-south-east, and south-south-east, had prevailed for about ten days in the early part of December and later, and also from the same general direction in the beginning of January, but more easterly; and that from the 12th to the 25th January strong winds, rising to gales, blew from north-east and east-north-east. The effective wind in January, at all the stations combined, came from east-north-east.

The above case, where the surface current was reversed owing to the action of strong and continuous winds from the south, east, and north-east, helps to explain, in my opinion, the normal movement southward along our east coast, and northward along the continental coast. In the early part of December the wind from the south would drive the water northwards; but later, when this northward movement was very marked, the gales were coming from an easterly and north-easterly direction. The surface water was therefore driven towards the coast of England, and, so to speak, heaped up there. It could not escape to the

south through the narrow and shallow Straits of Dover, and it therefore moved northwards along the English coast. The floats put in off the coast of Holland in January travelled to the coast of Norfolk; none, even at this period, was got farther south. If the wind, as above explained, could cause a reversal of the movement of the water, for most of the time at right angles to the direction in which it was blowing, it would appear probable that the same cause produces the normal movement which the experiments have shown to take place. The prevailing westerly and south-westerly winds must tend to heap up the surface water on the shallow continental coasts, especially of Denmark; the water cannot escape to the south for the reasons already stated, and it passes northwards, an indraught of surface water from the neighbourhood of the Orkneys passing down the east coast. Other possible conjoined causes must also be kept in view, such as the tidal stream and the rotation of the earth. The conclusions may be summed up as follows: (1) That there is at all seasons a fairly constant, slow circulation of the surface water in the North Sea, Atlantic water entering round the north of Scotland and between the Orkneys and Shetlands, and passing southwards along the east coasts of Scotland and England, as far as the neighbourhood of the Wash, then in an ENE. direction towards the coast of Denmark, and then northerly along the Danish coast. The surface water may or may not enter the Skagerack and penetrate to the west coast of Sweden and the south coast of Norway. The main body passes up the west coast of Norway and joins the Atlantic stream. The limit between the north-going eastern stream and the south-going western stream varies greatly, probably according to the prevailing winds; as a rule, the extent of the former is greater. (2) The movement of the surface water in confined areas, like the western part of the Moray Firth and the Firth of Forth, is irregular, and depends upon variations in the winds and the tides. (3) That, while the general circulation of the surface water in the North Sea is as above described, the current may be deflected by the wind, or even, under exceptional meteorological conditions, reversed. (4) That the speed of the movement is usually about two or three geographical miles a day, but may be much accelerated or retarded by the action of the wind. (5) That the principal cause of the circulation is probably the influence of the prevailing winds, driving the water towards the eastern side and tending to heap it up there.

It has been stated that the primary object of these experiments had reference to certain problems in connection with marine fishes, and a brief statement of some of the results may be of interest. The prevalence of a normal southerly movement of the surface water along the east coast of Scotland and England will tend to carry the floating eggs and larvæ of the food fishes in the same direction; so that spawning-grounds situated off any given part of that coast will furnish young fishes to the territorial seas farther south. From what is known experimentally as to the duration of the period of development within the eggs of different species at different temperatures, the rate of the movement of the surface water in which they are suspended, and the temperature of the water, it is possible to calculate approximately the distance the eggs may be

carried. For example, plaice spawn early in the year when the surface water is cold, and about twenty-three days elapse before the young fish issues from the egg under natural conditions. Even with a movement of the water so slow as two or three miles a day it will be seen that the floating eggs of the plaice may be carried a considerable distance before hatching occurs. Moreover, the pelagic period of the young fish —that is, before it settles on the bottom as a "flatfish," and while it is comparatively helpless—extends to several weeks, and during this time it may be carried much farther to the south. It is much the same with other species, such as cod, haddock and saithe, which spawn early; but with summer-spawning forms hatching occurs much sooner owing to the higher temperature of the water, and their eggs are not transported so far from the breeding-grounds. Every season billions of these floating eggs of the food fishes are shed into the sea and carried away by the surface current. One would therefore expect a corresponding migratory movement of the growing and adult fishes in the opposite direction, and this has been actually proved to occur with at least one form, the plaice. Many hundreds of this species were marked and liberated in the Firth of Forth and St. Andrews Bay, and it was found that their movement was northwards along the coast, several being recaptured in the Moray Firth after the lapse of a year or more; one, indeed, was caught off the north coast of Caithness more than two hundred miles from the place where it was marked and put into the sea. The direction of the surface current, as I have above described it, also explains the enormous abundance of young flatfishes in the great bight formed by the north coast of Holland and the western coast of Schleswig-Holstein, and on the shallow coast of Denmark. The multitude of young flatfishes in these regions is so great that the English trawlers for some time bound themselves by a voluntary agreement not to fish there, in order to prevent the immense capture of immature fish. And in Denmark, especially in the Limfjord, young plaice abound to such an extent that they are now being transplanted to other waters.

SOLAR ECLIPSES.

By Thomas Heath, B.A., First Assistant Astronomer,
Royal Observatory, Edinburgh.

The coming total solar eclipse of January 22nd, 1898, which is now attracting the attention of the scientific world, has been greatly enhanced in importance by the almost complete failure of most of the eclipse parties who left this country for Northern Europe and elsewhere in the autumn of 1896, a result due to the miserable weather experienced on that occasion. Its interest and importance would have been great in any case, because of the number of questions with reference to the sun's physical constitution which have still to be decided, and which can be approached only when the sun is totally eclipsed. It is somewhat unfortunate that the duration of totality is no more than two

minutes, and at many of the stations considerably less than that; yet, the track of the shadow lying, as it does, across the continent of India, the number of accessible points of observation will be very large. The risk of the final results suffering from temporary or local cloud will therefore be greatly reduced by a judicious scattering of the various parties. The general meteorological conditions are also most favourable, as the dry north-east monsoon sets in some weeks before the date of the eclipse, and rain at this time of the year is almost unknown along the greater part of the shadow track. Under these circumstances it is not surprising that numerous parties are making arrangements to take advantage of the opportunity of seeing this wonderful natural phenomenon, and, in the interests of science, recording what they see of it.

From the earliest epochs of history accounts have been handed down to us of the observation of eclipses, but within comparatively recent years, since the dawn of what may well be called the golden age of astronomical science, newly invented instruments and newly discovered methods of research have greatly enlarged the field of astronomical interest in them. The old methods of observing were confined specially to the object of obtaining the exact times and circumstances of the various phases of the eclipse, for the purpose of improving our knowledge of the complicated theory of the moon's motions, and the construction of tables by which these motions are predicted. This object has now, however, been so far attained that eclipses, either of the sun or moon, are no longer considered capable of affording the delicate measures of time and angles necessary for further advance in this direction, except when, as sometimes happens in the case of a lunar eclipse, the phenomenon is accompanied by the occultations of a number of fixed stars. In modern times the physical constitution of celestial bodies, including the sun, has occupied the attention of astronomers, and it has been found that total eclipses of the sun present opportunities of observing certain solar phenomena, such as are not to be had at any other time. The moon provides a screen to protect the eye from the superabundant brilliancy of the sun's light, and for a few minutes, at more or less long intervals, allows the observer to get a peep at those regions of the sun's atmosphere which are visible outside the edge of the moon's disc.

A total solar eclipse is visible only from a small portion of the earth's surface. This results from the following considerations. Since the body of the moon is much smaller than that of the sun the shadow of the former is always necessarily a cone, with sides converging to a point or apex. When the moon comes directly between the sun and the earth the cone is of such a length that the apex sometimes nearly reaches the earth's surface, and sometimes is rather longer than is necessary to reach the earth. Which of these phenomena takes place depends on the relative distances of the three bodies concerned. If at the time of eclipse the moon is farther from the earth than its average distance the cone is too short to reach the earth, and, moreover, the angular magnitude of the moon is then less than that of the sun; hence results an annular eclipse, so called from the annulus or ring of the sun's disc seen round the moon when the eclipse is at its greatest phase. On the other hand, if the

moon when between us and the sun is nearer to the earth than its mean distance, the shadow is then long enough to reach the earth, and the moon's angular diameter is now slightly greater than that of the sun. In this case a total eclipse is the result. How far the earth is immersed within the cone of darkness, and the consequent breadth of the shadow band which the moon, as it were, traces out on the earth's surface during its passage from west to east between us and the sun; by how much the moon's edge will overlap the edge of the sun, and what will be the duration of the total phase: through what latitudes and longitudes, whether on sea or land, the shadow band will pass—all these are questions which, though unsuitable for discussion here, are readily enough determined in advance by mathematicians. It need only be remarked that the duration of totality as seen from any one place never can be so much as eight minutes under the most favourable circumstances.

The varying circumstances of an eclipse depend, as we have said, on the relative distances of the three bodies concerned, and no two eclipses take place under quite the same conditions. The differences between two eclipses, and their causes, will be readily understood from the consideration of one or two examples taken at random. For instance, in 1889 there was a total eclipse of the sun on the 1st of January. At this time of the year the sun is nearly as far south of the equator as it can ever be. On this particular day the moon was also in south declination, but not so far south as the sun by nearly a degree. Hence the line joining the centre of the sun to the centre of the moon would incline northwards as it approached the earth, and we accordingly find that the apex of the shadow cone traced its band of obscuration altogether in the northern hemisphere. It began north of the Aleutian Islands, crossed the North Pacific Ocean, and reached the American coast, not far from San Francisco, and, after traversing several of the States, terminated in Canada. Again, in the beginning of January the earth is in that part of its orbit in which we have the sun nearest to us. His angular diameter was therefore at its greatest, or equal to 32′ 36″ of arc, while the moon's diameter, though not quite at its greatest, was still equal to 33′ 10″ of arc, or 34 seconds of arc greater than the sun's. Consequently, at the moment of central eclipse, the moon was not only large enough to hide the sun, but had 17 seconds to spare all round, and the duration of the total phase as seen from any one point depended chiefly on the time occupied by the moon in moving over 34 seconds of arc. Other circumstances of the eclipse, however, considerably modified the above simple statement, with the result that the duration varied from about 1 minute to 2 minutes at different points along the line of totality.

In the same year, on the 28th June, there was another eclipse of the sun. In this case the sun and moon were in north declination, the former being half a degree farther north than the latter. Hence the line joining the centres of the two bodies and prolonged to the apex of the shadow cone inclined towards the south, with the result that the line of central eclipse was throughout its whole course in the southern hemisphere. It commenced in the South Atlantic Ocean, reached the west coast of Africa near Walfisch Bay, and, after crossing the German terri-

tories and the north-west corner of Bechuanaland, traversed a region with which every one interested in African exploration will be familiar. As if intent on doing a little exploring on its own account it crossed the Zambesi river, and pursued its course through British Central Africa, till it reached the southern end of Lake Nyassa. Thence the line ran nearly parallel to the Rovuma river, finally leaving the African continent and solid ground at a point to the south of Cape Delgado. This was an annular eclipse, which, as we have seen, requires for its occurrence that the angular diameter of the sun should be greater than that of the moon. Now, in the end of June the sun is at its greatest distance from the earth and its diameter is the least possible, and it would seem as if a total eclipse were more likely to happen than an annular one. At the time of the eclipse, however, the moon was also nearly at its greatest distance from the earth, and its diameter, therefore, nearly the least possible. Now, it so happens that the moon's angular diameter varies much more than the sun's, the former having when nearest to us a diameter of $33\frac{1}{2}$ minutes of arc, and when farthest from us $29\frac{1}{2}$ minutes, while the sun's diameter varies from $32\frac{1}{2}$ minutes to $31\frac{1}{2}$. On the occasion of this eclipse the actual amounts were $31'\ 32''$ for the sun, and only $29'\ 28''$ for the moon. Hence at the time of central eclipse there was a ring of the sun's disc, 1 minute and 2 seconds of arc in breadth, left unhidden by the moon, and the light of this uneclipsed ring overpowers by its brilliancy the phenomena associated with total solar eclipses. For this reason annular eclipses are of comparatively little interest to the modern student of solar physics.

What, then, are these phenomena, for an examination of which, compressed into the short space of a few minutes, astronomers willingly undergo months of preparatory labour and serious thought, to be followed in many cases by long, tiresome, and expensive journeys to the chosen observing station, whither they transport tons of instrumental equipment and necessary baggage, and for which they will run the risk of dire disappointment, if only a whiff of envious cloud should happen to obscure the sky at the critical moment? The chief of them are undoubtedly the corona and the red prominences, and to these only need we refer at present. The corona may be described as a ring of bright light seen round the edge of the moon during the progress of the total phase, and extending outwards to a distance sometimes as great as the moon's diameter. In one or two instances observers have described it as so bright as to be almost unbearable to the unprotected eye; more often it is said to be about as bright as the full moon. In most cases it is accompanied by rays and streamers of vast dimensions and wonderful structure; occasionally by peculiar wedge-shaped masses of light, brighter than the rest, arranged irregularly round the moon's edge and appearing as if shining through the light of the corona. Its appearance, however, varies greatly in different eclipses. In one the rays and streamers may be entirely absent, and the corona then resembles a simple "glory" or halo round the eclipsed sun; in another the streamers form the conspicuous part of the spectacle, and add immensely to the grandeur of the spectacle.

The red prominences, or flames, make their appearance on the sun's eastern edge at the moment when total obscuration of the disc has just taken place, and again on the west when the total phase is about to come to an end. They stretch outwards from the sun's edge far into the region occupied by the corona. At one point a colossal pillar of red light is seen, at another huge cloudlike masses of fantastic shape are whisked about by some stupendous forces in operation on the surface of our luminary. Occasionally vast portions are seen to be separated and carried away into the outer regions of the solar atmosphere. Stretched along the same parts of the sun's edge are also seen red streaks of light, out of which the prominences seem to grow.

The first eclipse, in the account of which any distinct reference to the red prominences appears to have been made, was that of the year 1733. A Swedish astronomer, in his description of that eclipse, speaks of them as red spots separated from the moon's edge, and supposes them to form part of the moon's atmosphere. The red streaks were indeed spoken of a quarter of a century earlier, but it is a remarkable fact that no mention appears to have been made of these prominent objects in the records of earlier eclipses than these. The corona attracted attention at a much earlier date, mention of its appearance having been made by Philostratus and Plutarch. The accounts are, however, exceedingly meagre up to the middle of the present century, when the total eclipse of 1842, during which the prominences were very brilliant, afforded a great stimulus to observations tending to elucidate the mysteries of the physical constitution of the sun. Reasoning on the then existing knowledge of these phenomena the ablest men of the day were unable to decide, either what the corona and prominences consisted of, or whether they belonged to the sun or to the moon. It was even suggested that the prominences were optical illusions. On the occasion of the eclipse of 1860[1] photography was successfully called in to the aid of astronomy, with the triumphant result of proving beyond question that the prominences at least were certainly real appendages of the sun. A series of photographs secured by the late Mr. Warren de la Rue and Father Secchi showed that, as the total phase progressed, the prominences and red streaks were gradually covered on the east side, towards which the moon advanced, and as gradually uncovered on the opposite side. They could therefore belong only to the sun. Their nature was, however, still a mystery, but was destined to remain so only for a few years longer.

The Indian eclipse of 1868 was signalised by the attainment of decided information on this point, thus adding at least one well ascertained fact to the sum of human knowledge. In the interval between 1860 and 1868 the spectroscope and the science of spectrum analysis had made rapid strides in their astronomical application, and in the latter year were in a condition to be effectively used for observing the eclipse. The spectroscope cannot be said to have been in its infancy at this date, for it had been used in the early years of the century for the

[1] Daguerreotype photographs were obtained as early as 1842 of the crescent sun just before and after totality, and in 1851 of the Corona.

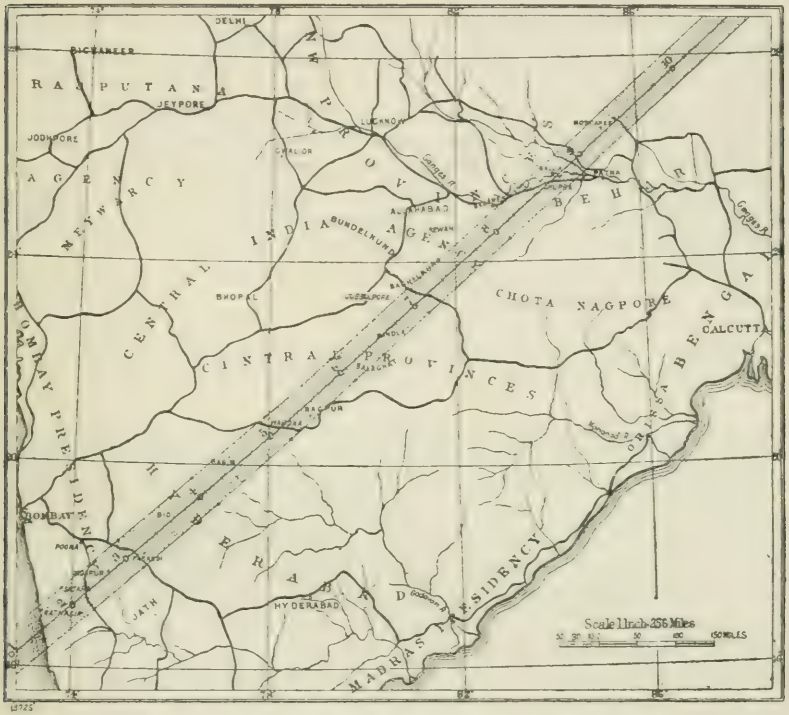
examination of the spectrum of solar light and for other purposes; indeed the principle on which the instrument is founded was known to Newton. It was well past the middle of the century, however, before its significance began to be understood, and its importance as a new instrument for astronomical research to be recognised.

When light is passed through the prism, or prisms, of a spectroscope it is "dispersed" or analysed into its variously coloured rays. If the source of the light examined in this way be a solid or liquid body, its spectrum is found to be continuous through all the colours of which the light is composed. If, however, the light passes through a layer of gas before reaching the spectroscope, it is deprived of certain of its rays by absorption, and the spectrum is wanting in light just at the points where these rays would otherwise fall. This is the case with the sun's light. Before reaching us it passes through both the sun's atmosphere and our own, and its spectrum is seen to be crossed by hundreds of black lines, showing that though the light emanating from the body of the sun is continuous through all the colours from red, orange, and green, to the blue and violet, it is deprived of a large number of rays by its passage through the gases existing in the sun's atmosphere, and of a further number of rays by passing through our own atmosphere. Laboratory experiments have shown to what gases or vapours most of these dark lines, or groups of them, belong. Thus, quite a large number are due to the vapour of iron in the sun's atmosphere, others to sodium, magnesium, etc. On the other hand, if the source of the light examined by the spectroscope be a glowing gas, its spectrum will be of a totally different nature. Instead of a continuous spectrum, the spectrum of a gas consists of a number of bright lines with long dark intervals between them. As soon as these facts, the first principles of spectrum analysis, were recognised, they at once suggested the means of determining the nature of the solar corona and red prominences. The expeditions which set out for India in 1868 to observe the eclipse were accordingly armed with the new instrument in addition to their telescopes, and were successful in showing that the spectrum of the prominences consisted of bright lines, proving beyond doubt that they were composed of glowing gases, and further, that these gases were mostly hydrogen, and, still further, that this gas exists, not only as it is seen during a total eclipse, round the edge of the sun's disc, but as a complete envelope surrounding the whole body of the sun. Soon after the eclipse it was shown simultaneously, but independently, by M. Janssen and Mr. (now Sir Norman) Lockyer, that by an adaptation of the spectroscope it was possible to see the prominences in broad sunlight. Thus our knowledge of this class of solar phenomena has been greatly increased.

With regard to the corona our information is by no means in such a forward condition, and much still remains to be decided. It is true that observation of eclipses subsequent to that of 1868 have proved its spectrum to consist of a small number of bright lines, along with a continuous spectrum, against which they appear as on a background. All but one of them appear to be due to hydrogen; but the remaining line, which is the brightest and most persistent, under all the varying condi-

tions of the corona, has not yet with confidence been attributed to any element known to exist on the earth's surface, or in its atmosphere. Under these circumstances the nature of the corona still remains to some extent mysterious.

Space will not admit of even a passing reference to more recent eclipses than those mentioned above, or to the various theories which have been suggested to account for the existence of the corona. Astronomers still find themselves face to face with this most interesting problem, and once more it will be attacked from Indian soil, in January of next year,



MAP SHOWING PATH OF THE MOON'S SHADOW ACROSS INDIA.

by expeditions from all parts of the world. Encouraged by the hope of such brighter meteorological conditions as will compensate for the disappointments of August 1896, many of the same enthusiastic band of scientists, their ranks recruited by the addition of new names, are again to the front, determined to make another effort to rob the corona of its secrets, or at least to do all that can be done in the short space of less than two minutes, which the moon's intervention will then place at their disposal. Let us wish them good luck, and a clear sky.

The Astronomer Royal for Scotland intends to observe the eclipse at Kurai, a somewhat out-of-the-way place on the highway from Nagpur

to Jubbulpore, and about fifty miles from the former city. Kurai is marked "6" on the accompanying map.

The chief instrument to be used is a horizontal photographic telescope, 38 feet in length, into which the light will be thrown by a fixed mirror. The image of the sun, $4\frac{8}{10}$ inches in diameter, formed in this way, is received on a sensitive plate 18 inches square, moved by clockwork. This instrument is so arranged as to give not only pictures of the corona near the middle of totality, but also spectrum photographs, by interposing a direct vision prism in the path of the rays, near the beginning and end of totality.

There is also a prismatic camera in which the optical parts are made of Iceland spar and quartz, so as to secure photographs of the extreme ultra violet spectrum, the rays of which are completely absorbed by glass. The other apparatus is of the usual character. Sir J. N. Lockyer's station on the Western seaboard is 520 miles from Kurai, while Pulgaon, the nearest of the other eclipse stations, is 105 miles distant on the railway near figure 5 on the map. The occupation of Kurai is thus important, as extending the British line of observing stations by fully one hundred miles, and increasing the chances of success should the weather be less favourable than is expected.

MRS. BISHOP AT THE ANNIVERSARY MEETING.

Mrs. Bishop delivered the inaugural lecture of the Session on November 9th, in the U.P. Synod Hall, before a large audience. Her subject was "The Chinese Far West," which she has recently visited.[1]

Ascending the Yang-tse-kiang as far as Wan-hsien, Mrs. Bishop there left the river for the highway to Cheng-tu, travelling in an open chair, which, being a novelty, attracted unpleasant attention from the natives, and accompanied by an escort of soldiers, who always ran away when she was assailed by hostile mobs. The road was in excellent condition, and thronged by coolies carrying opium, tobacco, and paper to the port of Wan-hsien. Coalfields appear to underlie the whole surface of Central and Northern Sze-chuan, and on the Kia-ling, which is navigable from Kuan-yuen to Chung-king, 500 miles, the coal traffic is enormous.

During this journey of seventeen days Mrs. Bishop was more than once assailed by mobs, to the great peril of her life. One of these attacks she described as follows :—

"A very great crowd, assembled at some *al fresco* theatricals, catching sight of a foreigner in an open chair in the distance, rushed down a broad, stony, dry river-bed and assailed me with fiendish howls—a sound once heard which can never be

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[1] The same lecture was delivered in London before the Royal Geographical Society, and is published in the July number of the *Geographical Journal*. The following short abstract only is, therefore, given here.

forgotten—uttering worse than the usual execrations, and calling on the bearers to set me down. The river-bed offered an excellent supply of ammunition, and the mob threw volleys of stones, hitting my chair and my coolies. At this juncture the soldiers of my escort fled. My hat was knocked off, and the next moment a well-aimed large stone struck me on the back of the head, and I fell forward stunned. On recovering consciousness, I found the chair set down, and an immense mob hooting and howling round me; but no more stones were thrown, a 'reason talker' having represented the riskiness of killing a foreigner; nor, though the howling with ruffianly accompaniments continued for some distance, was there any more actual violence."

Mrs. Bishop was much struck by the prosperity of the Cheng-tu plain, and its admirable engineering works. Speaking of it in her lecture, she said:—

"This glorious plain, with its four million inhabitants, its prosperous cities and villages, its innumerable palatial farmhouses among cedars, bamboo, and fruit-trees, its fine bridges, with roofs decorated in lacquer and gold, its stately temples, its enormous wheelbarrow traffic, its water and oil mills, its boundless fertility and wealth, and its immunity for two thousand years from drought and floods, are the monument of the engineering genius of one man, whose temple on a wooded height above the gorge of the Crouching Dragon, on the Min, is the most magnificent in China, bearing his motto incised in stone and lettered in gold in every conspicuous place, '*Dig the bed deep, keep the banks low.*' The river was divided, and the gorge through which one branch of it passes cut, B.C. 206, by Li Pin, a prefect in the kingdom of Shu, the present Sze-chuan."

From Cheng-tu Mrs. Bishop ascended the Min valley to Wei-chau, where she turned into that of the Siao-ho towards the Mantzu country. The villages along the Siao-ho are perched on the tops of hills, rocky pinnacles, or ledges of precipices, 5000 to 8000 feet above the sea and 2000 to 3000 above the river. Each village has one or more square stone towers, forty to ninety feet high and gently sloping inwards from the base to the summit. The bases of some are thirty feet square. The doorways are fifteen feet from the ground, and at present there is no ladder or staircase up to them. The Mantzu have no reliable information regarding the use to which these towers were put, but Mrs. Bishop's opinion is that they were refuges, in which the cattle were below and the people above. The villages and lands on the lower Siao-ho were taken possession of by the Chinese after the Tai-ping rebellion.

Through colossal scenery the road follows the left bank of the Siao-ho to Li-fan-ting, where the cañon widens out to a cavity of irregular shape, surrounded by tremendous mountains and by precipices, which, according to Captain Gill, attain a height of 3000 feet. At Li-fan the officials were astonished at the audacity of Mrs. Bishop, when she made known her intention of continuing her journey up the valley, and put every obstacle in her way. Mrs. Bishop, however, persisted and finally gained her point, and entered a part of China never before visited by a European. Three Russian explorers, Captain Gill, and some of the French missionaries have ascended the Siao-ho as far as Li-fan.

At Tsa-ku-lao, sixty *li* from Li-fan, the valley expands, and grand

views are obtained through wide openings of high conical, snow-clothed peaks, heavily timbered below the snow-line. One group, called by the Chinese the "Throne of Snow," consists of a great central peak with nine others of varying altitude around it. After crossing a spur known as the Pe-t'eo-shan by a pass 9750 feet high, Mrs. Bishop came to the frontier Mantzu village of Ku-ri-keo, where her Chinese escort was replaced by a Mantzu, consisting of two lively, handsome girls, who were far more efficient protectors than their male predecessors. In cases of emergency these girls adopt a symbol of "deforcement" more curious, and, it seems, more efficacious, than that formerly made by bailiffs with their baton and ring.

"Nor was this fascinating escort a sham. Before starting, each of the girls put on an extra petticoat. Had any molestation been seriously threatened, after protesting and calling on all present to witness the deed, they would have taken off the additional garments, spreading them solemnly on the ground, there to remain till the outrage had been either atoned for or forgiven, the nearest man in authority being bound to punish the offender."

At Mia-ko, two days' journey above Ku-ri-keo, the Siao-ho makes a long curve, which was avoided by crossing the pass Tsu-ping, 10,117 feet high.[1] The cold was intense, the thermometer standing at 6 A.M. at 24°, while at noon, 2000 feet lower, it marked 72°. On this pass a glimpse was obtained of a snowy range, on which five peaks, evidently of great altitude, are superimposed. The guide said that this range was covered with snow all the year round, that the peaks were called the "Snowy mountains," and that the great Gold river rose among them. Judging from the snow-line, which Captain Gill found 3° eastward to lie at 13,000, Mrs. Bishop estimated the height of the peaks at nearly 17,000 feet. This range is the Tsu-ku-shan, running in a south-westerly direction and forming here the eastern boundary of the province of Sze-chuan. It was presently crossed by a pass 13,017 feet above sea-level, and here Mrs. Bishop, having started too late in the day, encountered perils almost worse than she had been exposed to from the Chinese mobs. The following extract graphically depicts the situation:—

"The noses of the coolies had been bleeding at intervals for several days, and as at that altitude the hæmorrhage became profuse, after stumbling in the snow for a short time in the darkness, they set down my chair, very reasonably, I thought, and no arguments of Mr. Kay's, addressed either to mind or body, induced them to carry it another step. It was then 8.30 (P.M.), and very dark. A snowstorm came on, dense and blinding, accompanied by a strong wind. The snow drifted heavily; the guide continually disappeared, and was with difficulty recalled. I sank several times in drifts up to my neck, and was so exhausted as to be dragged rather than helped along by two men. My servant, a big, strong fellow, fainted and fell down on the snow, but was reanimated by pouring brandy down his throat. The coolies called on their gods, and made expensive vows, which they afterwards fulfilled by burning cheap incense sticks, and as we staggered through the blinding drifts, I at one time doubted whether Tsu-ku-shan

[1] As the instruments used were not reliable, this and other altitudes given may not be very accurate.

would not be the journey's end. After four hours of this work the moon rose, the snow ceased, and soon after midnight we reached the top of the pass."

On the farther side the travellers came to the Matang river, which descends to the Rong-kia, a broad rapid stream flowing south-westwards through beautiful, well-wooded country, and presently arrived at the town of Somo. In a fine castle resides the T'u-ssu of Somo, the head of the tribe of Mantzu inhabiting the district. These rulers are appointed by the Emperor of China, but by long-established custom their office is hereditary. They exercise complete sway in their own territories, and little recognition of the Chinese suzerainty is expected of them beyond the payment of tribute. The Mantzu are a fine healthy race, and their women are handsome. In religion they are Buddhists, and in no country are the outward signs of religion so numerous and conspicuous.

Being prostrated by the severe night on the Tsu-ku-shan pass, and finding that, a tribal war having broken out, the journey to Ta-chien-lu would be more than usually difficult, Mrs. Bishop decided to turn back at Somo. Retracing her steps as far as Cheng-tu, she descended the Min and the Yang-tse-kiang to Chung-king, and thence to Ichang.

During the course of her lecture and at its close, Mrs. Bishop exhibited a number of interesting lantern slides, concluding with portraits of her intrepid Chinese escort.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting held on November 17th, the following ladies and gentlemen were elected Members of the Society :—

Annandale, Miss N. A. J.
Bremner, Miss E. H.
Cossar, Mrs.
Cousans, Miss G.
Gibson, Miss E. C.
Guthrie, Mrs. F. H., M.D.
Middleton, Miss J. P.
MacDougall, Miss.
Nash, Miss A. E.
Nelson, Mrs. C. I.
Pearson, Mrs. D. G.
Richardson, Mrs. H. C.
Sinclair, Mrs. E. J. M.
Swan, Mrs.
Swan, Miss.
Workman, Mrs. F. B.
Balfour, John D.
Bannerman, W. B.
Bryson, A. G.
Clark, Francis W.
Cree, J. E.
Davidson, John.
Gidden, James L.
Gregorson, A. M.
Hamilton, J. B.
Kirkpatrick, J. G.
Learmonth, John W.
Lima, Chrysologo de.
Macpherson, C. E. W.
Macray, Rev. W. R.
Malcolm, Alexander G.
Menzies, J. S., Jun.
Mitchell, Dr. R. B.
Neilson, John.
Osborne, John C.
Reid, James R., C.I.E.

Reith, Rev. G. M.
Robertson, J. H.
Robson, Rev. John, D.D.
Saldanha, Dr. L. C.
Sime, Thomas.
Steel, W.S., D.L., J.P.
Thomson, Charles.
Welwood, J. A. Maconochie.
White, John.
Wight, Robert.
Wilson, Charles J.
—In all forty-seven.

A Diploma of Fellowship was conferred on T. Frame Thomson, Esq., C.E., A.M.I.C.E.

The following gentlemen were elected Corresponding Members for the present session :—

Anderson, R. Hay, Esq., . . *Mexico*
Ballivian, Don M., . . . *Bolivia*
Bell, Dr. Robert, . . . *Ottawa*
Bodio, Professor Luigi, . . *Rome*
Chaix, Professor Paul, . . *Geneva*
Cockburn, Henry, Esq., . . *China*
Corstorphine, Professor, . *Cape Town*
Dingelstedt, Mons. V., . . *Geneva*
Harrington, Mark W., Esq., *Washington State*
Johnston-Lavis, Dr., . . *Monaco*
Macdonald, Dr. W. H. B., *Mombasa*
Margerie, M. de, . . . *Paris*
Mason, W. B., Esq., . . *Japan*
Mello, Professor Carlos de, *Lisbon*
Mohn, Professor H., . *Christiania*
Mulhall, Michael G., Esq., *Buenos Ayres*
Penck, Professor A., . . . *Vienna*
Pittier, Professor, . . *Costa Rica*
Russell, Professor I. C., . *Michigan*
Steffen, Dr. Hans, . . . *Chile*
Stevenson, Prof. J. J., . *New York*
Suess, Professor, . . . *Vienna*
Thomson, J. P., Esq., . *Queensland*
Wagner, Professor H., . *Göttingen*
Wells, Colonel H. L., . . *Teheran*
Wild, Dr. J. J., . . *Melbourne*
Willoughby, Rev. W. C., *Bechuanaland*
Woodford, C. M., Esq., *Pacific Islands*
Wragge, Clement L., Esq., *Brisbane*
Yate, Captain A. C., . *Baluchistan*

The Annual Business Meeting

was held in the Society's Hall on the same day at 3 P.M. Sir John Cowan, Bart., presided.

On the recommendation of the Council the Marquis of Lothian was re-elected President, and the Vice-Presidents were re-elected.

The following twelve Members of Council, who retire by rotation, were re-elected :—Colonel Cadell, Mr. D. F. Lowe, Professor Copeland, Captain Hamilton Dunlop, R.N., Dr. Rogerson, Dr. George Smith, General Sir R. M. Smith, Mr. W. B. Blaikie, Mr. R. A. Robertson, Mr. James Henderson, Mr. Victor Fraenkl, and Rev. Professor George Pirie.

In the room of the other eight Members of Council, who retire by rotation, and of the late Dr. Scott Dalgleish, the following gentlemen were elected :—Lord Provost Mitchell Thomson, Colonel Dods, Sheriff Æ. Mackay, Mr. J. B. Sutherland, Mr. W. C. Dunbar, Mr. A. J. Herbertson, Professor Prothero, Mr. W. F. G. Anderson, and Mr. T. S. Ross.

Dr. James Burgess was elected Honorary Librarian in the room of Mr. D. MacRitchie, who has resigned.

All the other office-bearers were re-elected. The report of Council for the past session was adopted, on the motion of the Chairman, who drew attention to its principal features and commented on the continued prosperity of the Society, seconded by Mr. R. L. Gwilt.

A vote of thanks to the Chairman was proposed by the Rev. Dr. M'Ewen and carried unanimously.

Lectures delivered in November.

The Anniversary Meeting was held in Edinburgh on Tuesday, November 9th, when Mrs. Bishop, F.R.S.G.S., F.R.G.S., delivered, in the U.P. Synod Hall, a lecture on the "Chinese Far West." The Marquis of Lothian, President of the Society, was in the Chair, and Sir Lewis M'Iver, Bart., M.P., proposed a vote of thanks to Mrs. Bishop, which was seconded by Dr. George Smith.

The Glasgow Branch held its opening meeting on the following evening in the Berkeley Hall. Mr. R. S. Allan presided.

The Dundee Branch assembled to hear Mrs. Bishop on the 11th. Mr. I. J. Weinberg presided, and Mr. T. S. Ross proposed the vote of thanks to the lecturer.

The following evening Mrs. Bishop addressed the Aberdeen Branch in the Y.M.C.A. Hall. The Chair was taken by Professor Pirie, and Mrs. Bishop received a hearty vote of thanks on the motion of Dr. Ferguson of Kinmundy.

Limelight views were exhibited at the conclusion of the lectures.

Lectures in December.

Three lectures will be delivered in Edinburgh during the month. On the 3rd, Dr. Sven Hedin will address the Society on his explorations in Central Asia; the following week Lieutenant Peary will lecture on his explorations in Greenland; and on December 16th Mr. Alfred E. Pease, M.P., will describe his recent journey in Somaliland.

Dr. Sven Hedin will also lecture to the Glasgow Branch on December 6th, and at Aberdeen on December 7th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Steam-Rams in Northern Ports.—Admiral Makarof has lately discussed, before the Russian Geographical Society, the practicability of keeping open Russian ports during the winter. At present all the ports of the Empire, except one or two in the Black and Caspian seas, are annually closed by ice for longer or shorter periods, while goods accumulate in the warehouses, and vessels have to sail homewards in ballast lest they should be frozen in. By the use of steam-rams M. Makarof maintains that these ports might be kept open throughout the year, to the great advantage of commerce and of the country at large. That this is not a vain dream is proved by the success which has attended the efforts that have already been made. In Finland the port of Hangö is kept open by the steam-ram *Murtaia*, and the little town becomes in winter a busy commercial centre. Vladivostok, also, which used to be closed for four or five months in the year, was in 1893 furnished with a steam-ram, which keeps the entrance clear through the winter, and in the winter of 1896-97 a steam-ram carried the trains of the Ural railway across the Volga at Saratof, even with 72 degrees of frost. M. Makarof asserts that it is, therefore, possible to maintain communication between the open sea and the port of St. Petersburg, which is annually shut in by 370 miles of ice, and, moreover, he proposes to establish a fleet of steam-rams to ply between the Siberian rivers and the open sea, at any rate in summer. A ram with engines of 52,000 horse-power, or two with a power of 36,000 each, the one pushing the other, could force a passage through the Polar ice even in winter. But in the

meantime two schemes will suffice—to keep open the port of St. Petersburg through the winter, and to maintain a constant service to the mouth of the Yenesei. Two vessels of 10,000 horse-power, and a displacement of 6000 tons each, might be employed in winter in keeping up communication between St. Petersburg and the open sea, and in summer be engaged in the trade between Archangel and the Yenesei.—*Mouvement Géographique*, October 3rd.

ASIA.

The Marine Survey of India.—When the previous report was written the *Investigator* was engaged in Bombay harbour, in the neighbourhood of Karanja, while the *Nancowry* was employed at the Thana and Bassein creeks. Subsequently the *Investigator* surveyed the Dharamtar creek and the Amba river as far as Nagothna, twenty-six miles from the entrance, while a party under Lieut. Kendall carried the work up the river. Meanwhile the *Nancowry* moved into the Panwel creek, and surveyed it as far as it is navigable for steamers.

During the recess a number of charts of the above creeks and of the Indus delta were drawn, and a programme of work for the next five years was submitted to the Government of India, and approved. The north part of the Andamans, including Cocos Channel, was to be surveyed in 1896-97 and in 1897-98, and also the Gulf of Martaban and the Baragua flats. In 1898-99 and 1899-1900 work is to be carried on at the Andamans and Moulmein, and in the latter year and in 1900-1901 the coast from Honawar to Mangalore is to be surveyed. The coast from Madras to Port Cabinere and the harbour of Madras are also put down for these two years; afterwards the coast from Chittagong southwards will receive attention.

In October last year, after a visit to the Maldivhs, where some soundings and casts of the trawl were made, the *Investigator* sailed for the Andamans and proceeded to survey the northern end. A triangulation had previously been made by the Great Triangulation Survey Department, but, as several of the positions could not be found, it was necessary to repeat most of the work, a base being obtained between two of the Triangulation Survey marks at the south end of the part to be surveyed, which were fortunately identified. On January 3rd the *Investigator* left the Andamans and sounded up to the Krishna light-vessel off Rangoon. When in lat. 13° N. and long. 94° 37′ E. a depth of 377 fathoms was struck, and as this was much shallower than the previous soundings several more were taken in the neighbourhood, but no lesser depth obtained. After a visit to Rangoon a search was made for the Vita shoal, reported by the master of the s.s. *Vita* to lie approximately in lat. 15° 31¾′ N. and long. 95° 30¼′ E. The search was extended over ninety sq. miles without success. Considerable changes were found to have taken place immediately to the south of Krishna, the depth at twenty fathoms having deepened, while to the eastwards the outer soundings were all shallower than on existing charts. The re-sounding of the Gulf of Martaban was still in progress at the date of the report, April 1st.

The following are details of the principal trawls :—

Station.	Position.	Depth in Fathoms.	Deposits, Bottom and Surface Temperatures.
216	6° 55′ 18″ N., 72° 50′ 25″ E.	770	Grey Ooze. 41° F.; 81° F.
217	6° 55′ 56″ N., 72° 52′ 30″ E.	459	Dark Grey Sand. ... ; ...
222	13° 27′ 0″ N., 93° 14′ 30″ E.	200—400	Green Mud. 48° ; ...
226	14° 26′ 0″ N., 96° 23′ 0″ E.	67	Coral. ... ; ...

No very remarkable forms seem to have been obtained. Near the Maldivhs (Station 216) two comparatively rare holothurids were fished up, and in the Gulf of Martaban two species belonging to the genus *Squilla*. One of these had two glistening brown spots on its carinated telson, looking like eyes. The surgeon-naturalist, Mr. J. Wemyss Grant, conjectured that these are for the purpose of deceiving animals which prey upon the fish and drawing them off from the fore (vulnerable) part of its body. The curious jumping fish (*Periophthalmus Koelreuteri*) occurs in large numbers among the mangrove swamps of the Andamans.—*Report for* 1896-97.

M. Bogdanovich on the Okhotsk Coast.—Letters from this traveller, whose expedition was briefly announced in vol. xiii. p. 157, are published in the *Izvestiya* of the Russ. Geogr. Soc., No. 1, 1897. The first is written from Chumukan, at the mouth of the river Udy, the only permanently inhabited spot in the district, that is, in the tract between the gold mines of Nicolaievsk, Ayan, and Amgunsk. The population consists of a few families of Cossacks, a few peasant families who chanced to find their way thither in the forties, some Yakuts and Tunguses. The only reason of the existence of the settlement is that it is a Government depôt for corn and a market for furs. A broad, open bay, on the north-western side of which rise the sharp ridge and summits of the Stanovoi mountains, a low coast, broad *tundras* stretching eastwards along the right bank of the Udy, which flows down from hills on the south—such are the surroundings. From the direction of the Udy blows very frequently a terrible south-west wind, with nothing to stop its progress but the wretched Yakut structures grouped around the church and factory. During the winter the hut in which M. Bogdanovich stayed had constantly to be cleared out of the snow, which even found its way inside. After a short interval of calm the wind would change to north-east, with snow and storm.

Arriving at Nicolaievsk on October 1st, M. Bogdanovich was able before the freezing-up of the Amur to make only one excursion to the opposite bank for the purpose of observing the Tertiary deposits with remains of vegetation, overlying the tops of the cliffs of porphyry and melaphyre. The melaphyric rocks reminded him strongly of the Siberian traps, both in their petrological character and in their bedding. To the west of the Amur, along the coast up to Chumukan, are clay-slates and sandstones, sometimes quartzites, covering granite, or in some places syenite and porphyrite. The uniformity of the geological formation is reflected in the contours of the surface. Broad river valleys, with swamps in wet years, covered with sparse vegetation, mountains with soft outlines, clothed in the hollows with wonderfully luxuriant woods and often passing into steep, bare groups and ridges, sometimes with bold contours, succeeded one another along the route, alternating with open bays of the sea. The sea sometimes cuts off large masses from the continent, sometimes runs into the land, forming continuations of the valleys. From the height of the pass over the Alski range, rising to a height of four thousand feet, a view of the Shantar islands was obtained, and by the shore, quite free of snow, the party reached Chumukan on February 11th, having left Nicolaievsk on January 7th. The snow on the route was deep, and the reindeer sank through it to the ground below, so that it was necessary to make the journey on snowshoes. The cold was intense, the spirit thermometer falling at night to $-40°$ and $-50°$ F. Nevertheless the march to Chumukan, 357 miles from Lake Oroll, was accomplished in twenty-nine days, with three days' rest. M. Bogdanovich thinks that if one may speak of a pole of snow as well as a pole of cold, such is to be found here, between the last spurs of the Little Khingan, on the left banks of the Amur and Amgun, and the south-eastern slope of the Stanovoi mountains.

The quantity of snow was noticed by the Yakuts and Tunguses, who pay particular attention to it, because on it depends the prospect of obtaining food for their animals, and consequently the ease or difficulty of the journey.

At Nicolaievsk M. Bogdanovich made a search for the bog-iron ore that was known long ago. By excavations 15 to 40 feet deep he discovered that it exists in late deposits, probably of Post-Pliocene origin, and consists of accumulations of ore in clayey sandy layers covering the porphyry, or, rather, melaphyre. Prospecting for gold was begun on the south-eastern side of the Alski range, which evidently constitutes a continuation of the Little Khingan ; on the other side it is continued in the Great Shantar island. Gold dust was, however, met with only once.

In the times of Middendorf and Meglinski the Udski district was the highway between Yakutsk and the Amur. The Udski fort was the administrative centre, to which converged all the routes, and to which the Tungus nomads gravitated ; and the furnishing of the trading factories with corn and cattle drew thither large number of Yakuts. But on the discovery of gold on the Zeya and Niman, and, lastly, on the Amgun, the tide of population turned, and the prosperity of the district fell off considerably.

The Stanovoi mountains, within the limits of the district—that is, on both sides of the river Udy—present a complex system of ranges which retain a marked individuality only for short stretches. From the top of the watershed of the Jugjur a whole sea of elevations is visible on the horizon, among which, as far as the river Udy, only two ridges stand out distinctly—the one at the upper waters of the river Nemerikan and the right-hand sources of the Yana, the other in the source region of the Tutkan, an affluent of the left bank of the Udy. On the right bank of this river are also distinguishable, and still more clearly, two ranges—the Tylski, between the rivers Torom and Tylom, and the water-parting Alski. Farther along the right side of the river Tundra are displayed a whole series of ridges separating the Udy and Amur districts, two regions differing in their geographical and geological characteristics. The relationship of these ranges to one another and to the Jugjur cannot easily be explained in a few words, and much remains to be learned. There is a marked orographical, and in all probability geological, difference between this slope of the Stanovoi mountains and that which feeds the gigantic system of the Lena. While from the top of Jugjur a complex system of elevations is revealed on the side towards the Udy, on the Lena side appears an endless network of low-lying streams, winding among elevations with gentle contours and mingling together on a sloping plain under the cover of impenetrable jungle. On the one side are systems of mountain ranges, on the other a gradual slope.

The range at the head of the Nemerikan may be traced south-westwards to the range dividing the middle course of the Udy from its largest left-hand tributary, the Maya or Polovinaia, and extending to the parallel of Ayan. A third, called by M. Bogdanovich, the Maritime range, stretches along the coast from Chumukan to Ayan under different names—Salajan, Niadala—and from the sea conceals with its wild rocky summits the other sections of the Stanovoi system distinguished by smoother and gentler contours. This third range possesses a more marked individuality than the second or Jugjur. Probably the second range is the remains of a much older elevation, extending north-eastwards, folded subsequently by movements connected with the evolution of Jugjur, which, under the influence of the older mass, was diverted in many parts from the prevailing north-easterly direction. The third range is probably the result of a still later movement with a north-north-easterly strike, for it displays marked infractions of the uniformity of the Stanovoi system.

Amorphous crystalline rocks predominate throughout the system, and each range has its characteristic combination. Thus in the second range hornblende granite, gneiss, and syenite are found ; in Jugjur granites and gneisses of a different composition, as well as orthoclase porphyry ; while granites, diorites, and porphyrites are distinctive of the third range. Sedimentary rocks are entirely absent from the mountains, and crystalline slates are but slightly developed.

AFRICA.

The Berber and Suakin Route.—Five Special Correspondents have made the journey across the desert from Berber to Suakin. They left the wells of Mohobeb, just outside Berber, on October 31st. After fourteen hours' march they arrived at the Obak wells, where the supply of water was so small that it was with difficulty that the Bisharin could be persuaded to part with a little, having none too much for themselves and their flocks. In forced marches Ariab was reached on November 3rd. It is a huge natural basin, where wells of pure, crystal water are abundant, and rocky heights, with deep gorges, mimosa, and acacia, take the place of the desert. Thence to Suakin there was no difficulty in procuring water. The route runs for the most part through gorges between the mountains, some of which are 3000 to 5000 feet in height. The inhabitants, chiefly Hadendoas, possess large flocks, which were seen grazing on numerous fertile plains. On the night of November 9th the party emerged from the hills on to the plains round Suakin, and on the following morning reached the town.

Much discomfort was caused by the lack of provisions, dishonest servants having abstracted a considerable quantity of the supplies. The nights were cold, especially those passed at an elevation of nearly 3000 feet, and the water between Ariab and Suakin was filthy. It was curious to see large herds of gazelles more than eighty miles away from the nearest water it was possible for them to drink. Large numbers of hares, partridges, and bustards were also seen.

The Correspondent whose letter was published in the *Scotsman* of November 12th speaks unfavourably of the country as a railway route. From the Obak wells a range of sand, twenty-five miles long by five broad, would necessitate a long and difficult détour, and for twenty miles the line would have to be carried over rocky ledges by steep gradients, deep cuttings, and even tunnels in the solid rock. Ariab would yield the chief water supply, and, being very low, would be difficult to reach. Between Ariab and Suakin the country is still more mountainous, and the only possible route would be through gorges where raging torrents flow in the rainy season. In forty miles the ground falls nearly 3000 feet, and as about twenty miles of this stretch have a gentle slope, there must be a fall of about 2000 feet in twenty miles. The expense of making the railway would probably be so great that the undertaking would never pay for the outlay.

Boundary between Eritrea and Abyssinia.—The boundary proposed by Menelik, which the Italian Government will doubtless have to accept, runs from Tomat, near the confluence of the Setit (Takazze) with the Atbara, to Todluk on the Mareb, follows this river up to the mouth of the Ambessa, and then the latter river to its source, near Arresa. Then, crossing over to the source of the Fechu, it runs along this river to its mouth in the Upper Mareb, and follows the latter southwards for some six miles to its easterly tributary, the Mareta. Next it runs eastwards by Gura, Digsa, Halai, and Mahio to the plateau of the Galline Faraone, and then south-eastwards at about thirty-seven miles from the coast. Compared to the frontier laid down by the unratified treaty of Antonelli, the new line is less unfavourable than was at first feared. Half of Dembela, the whole of Seraï, and

about two-thirds of Okule-Kusai—the most favourable districts for cultivation and colonisation—are, indeed, lost, but Italy still keeps a foot on the plateau. In the south the boundary line runs at about 190 miles from the Benadir coast, striking the Jub north of Bardera.—*Geogr. Zeitschrift*, Jahrg. iii. Heft 11.

GENERAL.

Discovery of Water under Crystalline Rocks.—Sir Clements Markham draws attention in the *Geographical Journal*, November, to the discovery by Baron Nordenskiöld that fresh water can be found by boring through hard crystalline rocks to a depth of 30 to 35 mètres (98 to 115 feet). The method of boring through the granite rocks of Sweden was brought into operation two years ago, and now forty-four wells have been made. In his *Sketch of the Geology of Spitzbergen*, published in 1867, Baron Nordenskiöld gave reasons for supposing that a horizontal crack would generally exist in all solid rocks at an insignificant depth. The upper part of the Earth's crust is subject to variations of temperature, amounting at Stockholm, for instance, to a rise of 0·01° C. in a depth of 70 or 80 feet. If the crust were continuous and the changes of volume did not exceed the limits of elasticity of the rock, no disturbance would take place. But in all mountains there are clefts and fissures which expand and contract with the temperature, and if these be filled with sediment when enlarged by a lower temperature, their subsequent contraction will give rise to a powerful lateral pressure, and a slight dislocation will ensue. As this agency is at work from year to year, and an extensive movement of many hundred miles of the Earth's surface may cause folds at some narrow spot where the resistance is at a minimum, it is not surprising that even the newest formations are greatly folded, while older formations are quite undisturbed. Having collected information about certain wells in the vicinity of the coast, which yielded fresh water from depths of 100 to 250 feet below sea-level, Baron Nordenskiöld suggested to the Chief of the Pilot Stations that an experiment should be made, and accordingly the first boring was executed in 1891 on the little island of Svangen, south of the Kosterfjord. The locality had not been chosen by any one conversant with the subject, and the attempt failed, a crack extending to the sea being tapped. No other trial was made till 1894, when a boring was made at Arkö, beyond Braviken, through a rock composed of hornblendic gneiss and diorite. At a depth of 115 feet excellent water was reached, yielding 450 litres (99 gallons) an hour. Similar borings have been carried out successfully at forty-four different places. The temperature of the water is 43° to 45° F. at Stockholm, and 55° at Gelliavaara.

Baron Nordenskiöld is convinced that, wherever hard, close rock exists, water may be obtained in equal abundance with moderate pumping, and that the method might be applied successfully in many parts of the north coast of Africa, in Abyssinia, South Africa, at the foot of Mount Sinai, in the dry watersheds of the cañons of Colorado and elsewhere.

The Origin of Coral Atolls.—It has been admitted for many years that the dispute concerning the origin of coral islands could only be decided by borings. An attempt was made to apply this method during the cruise of the United States cruiser *Tuscarora*, but the boring tools broke off at a slight depth. In 1891 a committee was appointed by the British Association to arrange a new experiment, and consequently an expedition was sent out to Funafuti by the Royal Society and the Australian Museum conjointly. The observations were regarded by Admiral Wharton as opposed to Darwin's theory, whereas Mr. Hedley, of the Australian

Museum, maintained that the general structure of the island tended to confirm it (see p. 213). Accordingly, a new expedition has been sent out under the direction of Professor T. Edgeworth David of Sydney. A telegram of October 12th announced that a depth of 643 feet had been reached, and that the boring was being still carried down through coral rock. It may now be held to be proved that Darwin's theory is correct. The cores have not, indeed, been subjected to microscopic examination, and it may well happen that some of the slices cut from the deep core may show no sign of coral structure, being composed of fragments broken from the reef. It is to be hoped that some parts of the limestone from the bottom of the core will be sufficiently well preserved to show the nature of the formation. This one boring only proves, of course, that the method of subsidence is possible. But Darwin did not insist that his theory was universal, while, on the other hand, his arguments against the probability of many of the atolls in the Pacific having been formed on banks left by denuded volcanoes are still valid.—*Natural Science*, November.

Herr Andrée's Balloon Voyage.—The news of the killing of a pigeon sent out by Herr Andrée has been confirmed. It bore a despatch dated July 13, and giving the lat. 82° 2′ N. and long. 15° 5′ E. Under the circumstances it is difficult to explain the extraordinarily slow progress of the balloon, which advanced barely 155 miles in two days. At this rate it would take at least thirty days to cross the Pole and reach Alaska or Eastern Siberia, independently of the diminution which must take place in the buoyancy of the balloon. Dr. O. Baschin in the *Verh. der Ges. für Erdkunde zu Berlin* estimated the time it could keep afloat at eight days at most. In consequence of this information and the reports of whalers, who stated that they had seen what appeared somewhat like a balloon in the sea, and heard cries for help in the neighbourhood of Prinz Karl Vorland, a Norwegian relief expedition sailed from Tromsö on Nov. 3, in the *Victoria*, under the command of the whaling captain Sören Krämer. The vessel carries fourteen men, and is provisioned for six months.

MISCELLANEOUS.

Sir George Newnes has furnished Mr. C. E. Borchgrevink with funds (£15,000) to equip an **Antarctic expedition**. The expedition will sail next summer.

The India Office has issued a *List of the Factory Records of the Late East India Company preserved in the Record Department of the India Office*. Prefixed are some useful notes on the history of the towns where the factories were situated, and of the factories themselves.

Major Stanley Paterson has started for the **Orinoco**. His intention is to ascend the river to its southward bend, and then, following the course of the Cuchivero, cross the mountains to the Manipiari, making on the way an effort to climb Mount Icutu. He will then descend to the Orinoco, and, if time permits, explore some of its upper tributaries.

Captain Langheld, commandant of the station Tabora, who made an expedition to the **Rikwa lake** in January, reports that it has almost disappeared, and that its site is occupied by a steppe abounding with game. The natives say that about six years ago the lake was so nearly dried up that only a pool at Ukia, some 120 square yards in extent, and some large swamps at the south-west, remained of it.—*Petermanns Mitt.*, Bd. xliii. No. 11.

During the past five years **Lake Urmia** has been constantly rising, much to the consternation of the dwellers on its banks. In some cases hamlets have

collapsed, and meadows, fields, vineyards, and orchards, formerly six or eight hours' walk from the lake, have been converted into swamps by the gradual infiltration of the water. Astuan, near Khosrova, has disappeared, and Balean in the Urmia plain, where the water is usually thirty feet from the brims of the wells, is saturated with water.—*Deutche Rundschau*, Jahrg. xx. Heft 2.

Dr. Robert Sieger found evidence that the Armenian lakes were subject to periodical variations of level (see vol. v. p. 37).

During the past summer the weather in Australia has been unusually cold. Three falls of snow have been recorded in the Australian Alps, and the mountains Feathertop and Bogong were covered with 6½ feet of snow on March 15th. The low temperature is probably due to the presence of the numerous ice-floes which have been sighted by travellers on the way from the Cape. It is suggested that great volcanic perturbations may have taken place in the Antarctic region, which have detached large masses of ice and sent them adrift in the currents of the Southern Ocean.—*Revue Scientifique*, Oct. 16th.

There is always much that is interesting to the geographer in the *Proceedings of the Royal Colonial Institute*, and the 38th volume, lately issued, is no exception to this rule. Among the more geographical articles, those on Western Canada before and since Confederation, by Lord Strathcona and Mount Royal; on the work of this country in Central Africa, by Sir Harry Johnston; and on Lagos, by Sir Gilbert Carter, may be specially mentioned. There are numerous other communications of great interest, from either a commercial or political point of view; and as all are written by authorities on the subject treated, they are both useful and reliable.

An American gold prospector, named Ross, has discovered a new lake in the territory disputed between France and Brazil. Travelling with a companion, Ross crossed the Carnot river and reached the sources of the Carsevenne; then marching about thirty miles in a south-westerly direction, he came to the lake, from which flows the Mapa Grande, an affluent of the Carsevenne. The lake stretches from east to west, and has a length of twenty-two miles with a breadth of two and a half; the water is dark but clear. Grassy savannahs surround the lake, intersected by brooks skirted by belts of forest. All the varieties of game known in Guiana are abundant.

Mr. Pike and Sir Savile Crossley made a cruise last summer off the east coast of Spitsbergen and visited Kong Karls Land. Mr. Pike believes that the outline of Kong Karls Land, rising as it does to the east and west, while the centre is low, may have caused it to be mistaken for two or three separate islands. A small island, eight miles in length, lies a little north of the east end of Kong Karl, and east-north-east of Bremen a lofty island seemed to be situated, but the weather was thick, so that the existence of this island is doubtful. Sea-beaches, with driftwood, etc., fully 100 feet above sea-level, indicate that Kong Karls Land is rising.—*Geogr. Journal*, November.

The ridges of the Appalachians are, with some exceptions, usually considered to run along the synclinal axes, and the valleys along the anticlinal axes of the folded strata; and this is commonly considered the normal condition for old mountains of denudations. Mr. A. P. Chittenden states in the *Bulletin of the American Geographical Society* (xxix. 2, 1897), that measurements made by Mr. Lesley of the Pennsylvania survey give the number of miles of synclinal mountains as 245, compared with 334 anticlinal and 1333 monoclinal. Mr. Chittenden points out that this great proportion of monoclinal mountains in such a region is just what

we should expect, as the base-level cuts the troughs of the hard strata only as an exceptional case, and from the excavations below this base-level, formed in Cretaceous times in the Appalachians, the present surface has been formed.

Mr. Edward A. FitzGerald has sent to the *Geographical Journal*, November, a few notes on his expedition. He took trigonometrical measurements of the height of Aconcagua from the Horocones valley running north-west from the Puente del Inca. All the altitudes are not worked out yet, but those observed at five different stations, several miles from each other, give the height of Aconcagua as a trifle over 23,000 feet. It was owing to the curious behaviour of the aneroids that the height was at first supposed to be over 24,000. One sank to 12 inches at 19,000 and then broke, while another got out of order at 17,000 feet. Four mountains were climbed by members of the expedition. Mr. Vines ascended Aconcagua and Tupungato and an unnamed mountain, some 19,000 feet high, adjacent to Aconcagua, while Messrs. Lightbody and Gosse ascended one, about 17,000 feet high, in the Horocones valley.

Arrangements are being rapidly made by Mr. Clement Wragge for the establishment of a meteorological observatory on Mount Kosciusko, and a corresponding station at sea-level. The Lands Office, Sydney, in connection with the Surveyor-General's Department of New South Wales, is doing all in its power to assist, and has supplied valuable maps and full information as to the best means of reaching the summit. Unfortunately, neither Mr. H. C. Russell, Astronomer of New South Wales, nor Mr. P. Barracchi of the Melbourne Observatory, is in a position to provide for the registration of sea-level observations, and therefore an independent station must be formed at Sale, Bega, Moruya, or Eden. The town authorities are kindly exerting themselves to ensure the success of this part of the undertaking. The observers on Mount Kosciusko will be housed in a substantial pyramidal tarpaulin tent, and will be furnished with sleeping-bags similar to those used in Polar expeditions. In these they will be able to sleep without injurious effects, even out on the snow in the severest weather.—*Brisbane Evening Observer*, Sept. 14th.

NEW BOOKS.

Die Topographischen Capitel des Indischen Seespiegels Mohît. Übersezt von Dr. Maximilian Bittner, mit einer Einleitung sowie mit 30 Tafeln versehen von Dr. Wilhelm Tomaschek. Wien, 1897. Pp. 92.

The year of grace 1892 was marked by the occurrence of the fourth centenary of the discovery of America by Columbus, and this present year enjoys a like distinction, since it is the fourth centenary of another great maritime achievement —that of the discovery by Vasco da Gama of the new route to the East Indies by way of the Cape of Good Hope. The Imperial and Royal Geographical Society of Vienna has commemorated this great historic event by the publication of the *Festschrift*, or memorial volume, the title of which heads this notice. The work deals with a subject peculiarly appropriate to the occasion which has called it forth, consisting, as it does, mainly of translations from some of the most important chapters of a Turkish work called the *Mohît*, which describes the topography, navigation, and commerce of the vast eastern oceanic basin, and which, having been compiled (partly from older documents) not much more than half a century after Da Gama had opened up the new sea-route, is a record of unique

value of the long-subsisting state of things which his arrival in the eastern seas was destined to revolutionise. The introduction to this work, written by Professor Tomaschek, communicates much interesting information regarding the author of the Mohit, as well as regarding the nature and contents of his work. He bore the name of Seidi or Sidi Ali ben Hosein, and he flourished in the days of the powerful Sultan Soleiman Khan I., who reigned from the year 1519 until 1566. It is not known whether he was of pure Turkish descent, or had in his veins a mixture of Greek or of some other blood. Be that as it may, he gives ample proof in his work that he was a thorough master of all the astronomical and nautical science of his country and times, and since then the Turkish marine service has produced no one who stands with him on the same high level of merit. He held for a time the rank of a navy captain, and in that capacity served in the Egyptian fleet in the Indian Ocean and in the Persian Gulf. He was in that fleet which, bent on conquest and plunder, sailed from Suez in 1553, and which was eventually defeated by the Portuguese. Fifteen of the thirty ships of which it had consisted took refuge in Basra, and these Seidi Ali was commissioned by the Sultan to take back to the Red Sea. He never reached it. His squadron was twice attacked on the voyage by the Portuguese, and twice driven far out of its course by furious storms, and he was obliged to seek shelter in the haven of Surat. Here his nine remaining vessels, which were now little better than wrecks, were seized by the governor of that place. From Surat our unfortunate commander proceeded to Ahmedabad, where he remained for eight months, devoting his time to the study of Arabic and the compilation of the Mohit. These labours ended, he set out to return home, but, taking a long, round-about route, he was destined to see many men and many cities before he reached it. From Ahmedabad he went on, by way of Multan and Lahore, to Delhi, where he overworked himself in teaching the Mogul Emperor Humayun the use of the globes and the calculation of eclipses. Then, travelling westward, he crossed the Indus, passed through Peshawar and Cabul, and, having surmounted the Hindu-Kush, found himself in the upper regions of the Oxus. Proceeding thence through the province of Hissar, he crossed the river Wakhsh by the stone bridge (Pul-i-sangin) by which Alexander the Great had crossed it when marching to India. On reaching the plains he visited Kesh, Samarkand, Bokhara, and Khiva. At Khiva he found that the way through Russia was closed, and he had therefore to turn his face southwards. In passing through Persia he touched at the cities, among others, of Meshed, Damaghan, and Hamadan. Having next crossed the mountains over into Kurdistan he reached Baghdad, whence he proceeded through Mosul, Diarbekr, Kharput, Angora, and Constantinople to Adrianople, where the Sultan was then residing. Here the traveller, weary and worn, and bowed down by adversity, presented himself before his sovereign, and reported to him the failure of his mission. He lived only for a few years after his return, and died in 1562.

The term Mohit means, as Professor Tomaschek explains, that which is "umfassendes," *comprehensive*, that is, of all nautical matters. The work has hitherto been little known even on the Continent, and the only geographer in this country who made some use of it was the late Sir Henry Yule. Its author does not conceal the fact that in compiling it he consulted the works of certain Indian pilots for information to supplement his own. Some of these were of recent date, and others of them had long been in use.

Seidi Ali distributed his book into ten chapters, and each chapter into five sections. Of the ten chapters, the first four have been translated literally from Turkish into German for the work before us by Dr. Bittner, Privat-docent in the Vienna University. We cannot perhaps give a better idea of their nature and

importance than by quoting the headings of their contents:—I. Orientation,—measurement of the celestial circle, star-distances, and the reckoning of the altitudes of stars. II. Reckoning of time,—the solar and the lunar year, and the reform of the calendar. III. The divisions of the compass. IV. The course (*Verlauf*) of the Indian coasts—I. windward; II. leeward; III. the direct passages; IV. the islands and archipelago of the Indian Sea. V. An excursus on the new world. Dr. Bittner has also translated Chapter VI., which gives the altitudes of the Pole for all the specified harbours and islands within the compass of the Indian Ocean. These altitudes are reckoned in *isba*, or so many finger-altitudes of certain stars in the two Bears. He has translated also two extracts from Chapter VII. giving the longitude distances of a certain number of harbours. From all this (and much more might have been added had space allowed) it will be seen that the Mohit is a work of which the value can hardly be overestimated, and the Vienna Geographical Society has rendered a most important service to the cause of historical geography by bringing into conspicuous notice the contents and merits of this gem of nautical literature.

Hints to Teachers and Students on the Choice of Geographical Books for Reference and Reading, with Classified Lists. Prepared at the request of the Geographical Association. By Hugh Robert Mill, D.Sc., F.R.S.E. London: Longmans, Green, and Co., 1897. Pp. 142. *Price 3s. 6d.*

The Geographical Association did a great service to the cause they have at heart when they persuaded Dr. H. R. Mill to prepare this book. The work is divided into eighteen chapters. The opening one, which discusses in a succinct and readable manner the subject-matter of geography and its importance in education, is largely based on two lectures delivered to this Society and published in the *Magazine* (1892, 1895). The other chapters deal with Methods of Teaching Geography with Text-books, Atlases, Works of Reference, and books on the different divisions of general and special geography; and many teachers will be indebted to Dr. Mill for the good and sensible advice he gives, as well as for the judiciously chosen list of works, with brief annotations on most of them, which is appended to each chapter.

It is easy, of course, to mention omissions, for every one has his own list of works which he has found useful; but none of those we should have wished to add to the lists is essential, and most of Dr. Mill's books could not have been left out without damaging the completeness of his lists.

It may be permitted in this review to name one or two works Dr. Mill does not give, which have been found of value in the teaching of geography. As text-books we have found three series of French school-books by Schrader (*Hachette*), Marcel Dubois (*Masson*), and Vidal de la Blache (*Colin*) very clearly written, and in some respects preferable even to the German work quoted. In the list of atlases we should certainly have included Lehmann's and Petzold's new school atlas (see *S.G.M.* for October 1897), but it may have been published since Dr. Mill's work was prepared. For teachers, the second part of Vidal de la Blache's *Atlas-Général*, dealing with modern geography (Paris: Colin, 1894), is exceptionally valuable, for it contains numerous insets showing physical, climatic, biological, commercial, and ethnographical features, as well as graphic diagrams summarising statistical information for different countries, all of which are of great use in teaching. For the sea we find Justus Perthes' *See-Atlas*, by H. Habenicht (Gotha, 1894) a useful companion to the beautiful *Taschen-Atlas*. The *Album Géographique* of Professors Dubois and Guy—see review in next month's number of *S.G.M.*—might have been

mentioned as a useful and carefully selected picture-gallery arranged in an orderly way.

The *Physiographic Memoirs*, published by the American Book Company, are not included in the list of works on the earth's crust, as they might have been.

In commercial geography it might have been advisable to mention Mr. Yeats' books, and the interesting reading-book of Mr. Lyde on *Man and his Markets*.

Professor Shalers' *Our Continent* (*i.e.* America) ought to have been named, as well as the larger work on the United States which he edits.

In addition to Mr. Winsor's works on the discovery of America, perhaps Mr. Harrisse's might have been named; and we are sorry to see no reference to Professor Fiske's *Discovery of North America* (Boston: Houghton, Mifflin, and Co.), one of the most interesting works on the geographical problems and discoveries of the middle ages in relationship to what came to be known as the New World.

But such works are quoted because they have been found useful and not because their omission is a fault in this excellent little book.

We have noticed very few slips in this book of reference, where slips easily creep in. Ratzel's *Anthropogeographie* is in *two* volumes; the second, published in 1891, cost 18*s*. Brown's *Africa and its Explorers* is in *four* volumes; the fourth, published in 1895, cost 7*s*. 6*d*.

Finally, although Dr. Mill mentions his own books, he says nothing about their being models of concise and clear exposition. *The Realm of Nature* (revised 1897) remains the most symmetrical and satisfactory text-book in physiography for all students who have mastered the elements of the subject. This latest work of his should be in the hands of *every* teacher of geography.

With Plumer in Matabeleland: an Account of the Operations of the Matabeleland Relief Force. By Frank W. Sykes, assisted by C. G. Löwinger, C.E., and others. London: Arch. Constable and Co., 1897. Pp. 296.

The story of the Matabele war of 1896 is one that can be told only in the most meagre way by official reports or newspaper telegrams; and Mr. Sykes deserves the thanks of a wider public than that interested immediately in South African affairs for putting down on paper, imperfectly as he himself admits, a narrative of the stirring events of that year. Owing to the nature of the warfare, and the author's position as a trooper in the Matabeleland Relief Force, he gives an eyewitness's account merely of part of the campaign, but he has been at pains to supplement this by narratives obtained from those engaged in other detachments of the heterogeneous army, if such it could be called. Beginning with a short account of the causes of the war, and the effects of the rebellion, he proceeds to describe the march and work of the force under Colonel Plumer. The campaign in the Matoppo Hills is treated of at length, of course with much seemingly inevitable digression; and the fifth section of the book is devoted to an interesting and well-written description of the historic *indabas* when peace was concluded. If the author has done nothing more, he has at least made it certain that the campaign, soon perhaps to be forgotten, will not want a chronicler. The book is well illustrated by reproductions of drawings, photographs, and a map.

The Benin Massacre. By Captain Alan Boisragon, one of the two Survivors, Commandant of the Niger Coast Protectorate Force. London: Methuen and Co., 1897. Pp. 190. *Price* 3*s*. 6*d*.

The story of the mission to Benin, the massacre, and the escape of the author and Mr. Locke, District Commissioner of Warri, is told in a style not always free

from faults, but straightforward and unpretentious. So simple is the narrative of the escape, and so few are the incidents of a sensational character, that the reader may perhaps be tempted to underrate the courage and endurance displayed by the two men, who struggled for five days, with undressed wounds, and without food or water, through the densest jungle, full of insects, thorns, and other pests.

Unfortunately Captain Boisragon was disabled by the effects of his terrible march from taking part in the punitive expedition, and therefore can only give a few notes on Benin city from the accounts of others. According to these, even Ashanti had nothing to compare to the ghastly shambles of Benin. Now that the diabolical custom of human sacrifice is suppressed, and the country, with its many natural products, opened to trade, it may recover some of the prosperity it enjoyed in the early days of Portuguese maritime enterprise.

White Man's Africa. By Poultney Bigelow. Illustrated by R. Caton Woodville, and from photographs by the author. London and New York: Harper Brothers, 1898. Pp. 323.

When an author confesses in his preface that—"Perhaps I am the only writer on South Africa who cheerfully admits that he knows nothing of the subject"—we may not be justified in expecting much from his pages; but in this case his readers will find an agreeable surprise. The book is not geographical. Mr. Bigelow's interests are chiefly social and political, and he gives us his impressions in a racy and attractive style. If we accept his judgment as that of an unbiassed American, some of his conclusions are most interesting. He admires President Kruger, but condemns Boer government. His South African ideal seems to lie in the government of the Orange Free State, as representing all that is vigorous, flourishing, and in sympathy with the true development of the country. His final summing-up is worth quoting—"There must be no question of Dutch, of English, German, or French, if that country is to prosper; all must unite, and there are none too many. The flag of Great Britain represents freedom of trade, freedom of thought, beyond that of any flag on the high seas, and in Africa, at least, it is the only flag strong enough and generous enough for our purposes. It guarantees life, liberty, and the pursuit of happiness to all within the sphere of its influence. It is, in short, the only flag which to-day makes possible our dream of a White Man's Africa." The volume is handsomely got up and profusely illustrated.

Viajes de Fray Francisco Menendez a la Cordillera. Publicados y comentados por Francisco Fonck. Valparaiso: C. F. Niemeyer; Londres: Dulau and Co., 1896. Pp. 111.

In 1787, a hundred years ago, Fray Menendez ascended the river Vodudahue and, crossing the main cordillera, reached the watershed. Of this journey no tradition seems to have been preserved, and when Dr. Fonck published this journal, it possessed all the charm of novelty that belongs to the narrative of recent exploration. During the past summer Messrs. Stange and Krüger have, we believe, discovered many errors in the topography of Fray Menendez, at which no one, indeed, need be surprised, but still we must admire the energy and perseverance of a traveller who, a hundred years ago, penetrated into remote corners of the Andes, which have been only lately reached by Government explorers.

Dr. Fonck has added a large number of instructive notes on all places and subjects touched on in the narrative. He concludes with a chapter on the orography of the country, forming a supplementary chapter to his useful *Introduccion a la Orografia i Jeologia de la Rejion Austral de Sud-América*

published in 1893. Unfortunately he has introduced the boundary question into his exposition, and in this connection he regards the watershed as the central cordillera, speaking of the main elevation as a lateral cordon. We can here only express our dissent from this view, as a full discussion would take up too much space.

We are glad to learn that Dr. Fonck intends to continue his valuable contributions to the knowledge of the geography of Chile.

Onze Mois au Mexique et au Centre-Amérique. Par LAMBERT DE SAINTE-CROIX. Paris: Plon, Nourrit, et Cie., 1897. Pp. viii + 292.

Under the above title M. de Sainte-Croix has presented us with a very entertaining account of his travels in Mexico and Central America. The author, a French cavalry officer, knows how to observe and to write, and his descriptions of the different countries and their inhabitants—especially the female portion of them—are interesting and accurate. He found the New Panama Canal Company busily at work and everything in a very promising condition. The original plant, as far as it has not been used up by the wear and tear of the work done during the past eight years, is in almost perfect repair, and so are the docks at Aspinwall, or, as the French prefer to call it, Colon. Within seven years, and at a cost of five hundred millions of francs, he thinks the canal could be easily completed. The Nicaragua Canal, on the contrary, he considers a gigantic piece of American humbug. While the Central American republics would be a most suitable field for French traders and colonists, he scarcely met any of his countrymen in those parts, the enterprising German and the ubiquitous Jew abounding everywhere. Landing at the French port of Fort-de-France on the island of Martinique, after coming from Trinidad, he was forcibly struck with the contrast between English and French methods of colonisation: "We do not know how to colonise; when we go abroad we only think of return, while the Englishman makes a home for himself in the new country."

The New Zealand Official Year Book, 1896. Prepared under instructions from the Hon. R. J. Seddon, Premier, by E. J. VON DADELSZEN, Registrar-General. Wellington, New Zealand. By authority: John Mackay, Government Printer. Pp. 563.

This is an ably prepared Government publication, which must at once rank as a geographical authority of considerable value. A large section of the book is occupied with official information regarding the administration of the colony, together with social and economic statistics. Many of these tables, by interesting comparisons with other colonies, ought to fill the New Zealanders with self-satisfaction regarding their moral, hygienic, and material welfare. The concluding sections consist of articles on special subjects by the various official authorities in the colony. Thus, we have "Climate" by Sir James Hector, "Forests" by Professor Kirk, "Agriculture" by Dr. Murphy, and other subjects, each treated by its specialist. The country—its physical features, mines, soils, products, and commercial centres, is then systematically described in land districts by their respective district surveyors. Some statistical diagrams illustrate the tables, but the absence of maps is a distinct want in such a volume.

The Colony of Victoria, Socially and Materially. By WALDEMAR BANNOW. With general Map. Melbourne: M'Carron, Bird, and Co., 1896. Pp. 314. *Price* 2*s.* 6*d.*

The idea of this book is to set forth for the use of emigrants to Victoria the information they are most likely to require about the country—its natural

resources, industries, and institutions. This is done in a simple and popular manner, well arranged for reference and with a good index. The author appears to have spared no pains in becoming acquainted in detail with the numerous aspects of his subject, and as a result of journeying over seven thousand miles in the colony most of his information is from direct observation. As a practical guide for intending colonists such a work ought to be invaluable.

From the Brig o' Balgownie to the Bullers o' Buchan, with Golf Courses. By James Dalgarno, with illustrations by A. J. Murray. Third edition. Aberdeen: Jolly and Sons, 1897. Pp. viii+56. *Price* 1*s.*

This is an interesting little guide written from a historical point of view, illustrated by lithographic chalk-drawings neither very good nor very bad, prefaced by a poor map, and supplemented by notes on, and useful sketch maps of, the golf courses in the neighbourhood.

Die Donau von Passau bis zum Schwarzen Meere. Vienna: I. K. K. Priv. Donau-Dampfschiffahrts-Gesellschaft, 1897.

In this pamphlet the chief points of interest on the banks of the Danube from Passau downwards are noticed. The text is illustrated by a number of attractive illustrations, one of the most interesting, perhaps, being the new bridge at Czernavoda. Full particulars are, of course, given of the steamers and their times of starting.

The Company has sent us several copies, one or two of which are still at the disposal of members.

The Guide to South Africa for the Use of Tourists, Sportsmen, Invalids, and Settlers. Edited annually by A. Samler Brown and G. Gordon Brown. London: Sampson Low and Co., 1897. Pp. xlii+420. *Price* 2*s.* 6*d.*

As this is the third consecutive year we have noticed Messrs. Brown's excellent *Guide*, and no fundamental changes have been introduced into the book, we need only say that the editors have carefully brought it up to date, and improved it by numerous small additions. It can be thoroughly recommended.

Führer für den Auswanderer nach Brasilien. Von A. Papstein. Berlin: Deutscher Kolonialverlag, n.d. Pp. 83. *Price* 1 *Mark.*

The German Colonial Society has published a guide for emigrants going to Brazil, prepared by its correspondent in that republic. This is of some significance, since the Prussian Government recently rescinded the laws which prevented any Prussian settled in Brazil from claiming the protection of his native State; and, presumably, many Prussians will now go to the German colonies in that country. The guide-book gives a very good account of the geography, especially of the regions where Germans have settled. The new German emigration laws are printed as an appendix.

Aarbog for Dansk Kulturhistorie. Udgiven af Poul Bjerge. Aarhus: Jydsk Forlags-Forretning, 1897. Pp. 187. *Pris* 2 *kr.*

We have noticed this annual for several years past, and are glad to recommend it again to all interested in the manners of the past. In the present volume are articles, among others, on fatalism, by H. F. Feilberg; on pauperism in Denmark, by M. H. Nielsen; on socialism in Denmark, by Gustav Bang, while the editor contributes a few poems of the latter half of last century.

Bilder från Sverige. Utgifna af Svenska Turistföreningen. Stockholm: Wahlström und Widstrand, 1897.

This book, published by the Swedish Touring Club, contains 110 views taken in that country. They are all very well reproduced, and the subject of each picture is given in Swedish, German, and English, which last is occasionally a literal rather than an idiomatic rendering of the original.

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Jahrgang, 1894. Berlin: H. W. Kühl, 1897. Pp. xvi + 402.

This bibliography, now in its third year, is remarkably full, and its contents are so classified under a number of different headings, which are given in the index, that the student has little trouble in finding books and articles on any part of the world or any branch of geography and its allied sciences. We could wish that the publication were not so long delayed, but of course a work of this kind is the result of a vast amount of labour and, consequently, time.

Problems of Nature: Researches and Discoveries of Gustav Jaeger, M.D., selected from his Published Writings. Edited and translated by Henry G. Schlichter, D.Sc. London etc.: Williams and Norgate, 1897. Pp. 261.

Dr. Gustav Jaeger has made many suggestive contributions to Biology, the gist of which is now made available to English readers in this series of selections. Jaeger's reputation as a biological thinker has suffered in some degree because he left many of his far-reaching suggestions undeveloped, and because he emphasised certain opinions which have appeared to many to verge too strongly upon the eccentric. In illustration of undeveloped suggestions may be noted his early statement of the continuity of the germ-protoplasm—a concept which Weismann has independently elaborated to much purpose. In illustration of what is regarded by most biologists as an eccentricity, we may mention Jaeger's insistence on the importance of the "savorous and odorous matters" of the body. At the same time, Gustav Jaeger remains of much importance in the history of biology, as the originator of not a few clear ideas, and as an early champion of Darwinism in days when the evolution-doctrine was less popular than it is now.

The volume is divided into three parts:—I. *Zoological*, including essays on protoplasm, the origin of species, sexual selection, inheritance, the animal soul, etc.; II. *Anthropological*, including essays on human vitality, infection, immunity, development of infants, origin of language, etc.; and, III. *Varia*, including essays on Darwinism and religion, the different states of aggregation of matter, and (the only geographical contribution) the configuration of the Arctic regions, in which (1865) the author argued that "no land, but an ocean, will be found at the North Pole"—an interesting anticipation of modern discovery.

Dr. Schlichter's work has evidently been a labour of love. Perhaps he will pardon us when we point out two desirabilities: (*a*) that the work should be read by some friendly biologist in order to remove many terms and phrases which are not English, nor felicitous additions to our language; and (*b*) that there should be an adequate bibliography giving the original titles and sources of the various papers. Both these blemishes are serious, and might readily have been avoided.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Thirteenth Session, 1896-97.

The Council has the honour to submit the following Report :—

Membership.

The changes in the number of Members have been as follows :—

Number on 1st November 1896,		1414
New Members added,		278
		1692
Deduct by Deaths,	24	
„ Resignations,	55	
Struck off the roll by the Council (subscriptions in arrear),	15	
		94
Number remaining on 31st October 1897,		1598

This represents a net increase of 184 Members.

Of the present Members, 896 are on the Edinburgh list, 313 on the Glasgow list, and 109 and 107 on the Dundee and Aberdeen lists respectively ; in addition to the foregoing, 173 Members reside in England or abroad. 230 Members of the Society have compounded their Annual Subscription and become Life Members.

The Membership has never before stood at so high a figure as it does at present, the largest number of Members previously reported having been 1574, in 1890.

Diplomas of Fellowship.

The Council has conferred the Ordinary Diploma of Fellowship on the undermentioned Members of the Society who had complied with the conditions laid down in the Laws, viz. :—J. A. T. Ross Cormack ; Captain Duncan V. Pirie, M.P. ; T. Craig-Brown ; and John Maclachlan.

Finance.

The Council submits the annexed Financial Statement, which shows that the Funds at the close of the Session stood higher by the sum of £329, 3s. 5d. than they did at the commencement.

Meetings.

The Society held 24 meetings, of which 11 were in Edinburgh, 5 in Glasgow, 4 in Dundee, and 4 in Aberdeen. These meetings were addressed by Dr. Nansen ; Dr. Karl Grossmann ; Captain Joseph Wiggins ; Colonel Andrew Haggard, D.S.O. ; Dr. G. Dods ; Commander A. F Balfour, R.N. ; Dr. Fred. S. Zaytoun ; Mr. L. B. Clarence ; Colonel Sir C. E. Howard Vincent, M.P. ; Dr. Robert Bell ; Mr. W. Saville-Kent ; and Sir Henry Tyler.

A series of seven lectures, specially prepared for teachers, was delivered in the Society's Hall, under the auspices of the Society and of the Edinburgh Unity of

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1896 to 30th October 1897.

FUNDS AT CLOSE OF LAST ACCOUNT:—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,		301 9 10	
		£1900 11 7	
Deduct—Balances due to Bank of Scotland on Accounts Current at Edinburgh, £82, 5s. 9d.; at Glasgow, £10, 16s. 6d.,	£93 2 3		
Balance due to Secretary,	0 8 0		
	£93 10 3		
Less—in hands of Honorary Treasurer,	34 16 7		
		58 13 8	
		£1841 17 11	
ORDINARY SUBSCRIPTIONS:—			
23 Life Members at £10, 10s. each,	£241 10 0		
27 Annual Subscriptions at £1, 1s. for year 1895-96, £28 7 0			
1328 Do. Do. 1896-97, 1394 8 0			
21 Do. Do. 1897-98, 22 1 0			
	1444 16 0		
1 DIPLOMA Qualification Fee,	1 1 0		
FEES received for Society's Diploma—4 at £1, 1s.,	4 4 0		
LECTURE TICKETS sold,	737 19 6		
MAGAZINES sold,	60 3 9		
DIVIDENDS and INTERESTS, £67, 3s. 1d., *less* paid to Bank, 2s. 5d.,	67 0 8		
DONATIONS to Medal Fund,	24 0 0		
		2580 14 11	
		£4422 12 10	

MAGAZINES, Printing, Paper, Lithographing, etc., from Nos. 9 to 12 of Vol. XII., and Nos. 1 to 8 of Vol. XIII., all inclusive, and for Postage, Delivery, etc.,			£658 6 9
Less—Received during the year for Advertising,			60 0 0
			£598 6 9
GENERAL PRINTING,			35 14 0
BOOKS and other Furnishings for Library,			33 5 7
RENTS OF HALLS, and other expenses of Lectures, including payments in connection with Dr. Nansen's meetings,			893 7 0
RENTS OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,			127 1 0
SALARIES:—			
To *Secretary*, to 15th October 1896,	£200 0 0		
,, *Librarian and Clerks*,	272 0 0		
			472 0 0
MISCELLANEOUS, including Stationery, General Expenses, Advertising, Cleaning, Postages, and Office Furniture, and Furnishings at Glasgow Branch,			63 4 0
MEDAL FUND,			27 13 0
EXPENSES attending Meeting of British Association,			1 0 2
			£2251 11 6
FUNDS AT CLOSE OF THIS ACCOUNT:			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,		301 9 10	
		£1900 11 7	
Balances due by Bank of Scotland on Accounts Current at Edinburgh, £194, 15s. 10d., at Glasgow, £25, 2s. 4d.,	£219 18 2		
Balance due by Honorary Treasurer, £46, 0s. 11d., and by Secretary, £4, 10s. 8d.,	50 11 7		
		270 9 9	
			2171 1 4
			£4422 12 10

Edinburgh, 12th November 1897.—I have examined the Accounts of the Royal Scottish Geographical Society, for the year ending 30st October 1897, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

HUGH BLAIR, C.A.

the Empire Association, by Professors Kirkpatrick and Prothero of the Edinburgh University.

The Society's Magazine.

The *Magazine* has appeared each month with the usual regularity. In the absence of Mr. Taylor during three months of the summer, the duties of Editor were successfully performed by Mr. A. J. Herbertson, F.R.S.E. The Council desires to acknowledge its indebtedness to contributors of articles, and to the following members of the Society who have given valuable assistance to the editors:—J. G. Bartholomew; George Bickerton; J. W. Brodie-Innes; Dr. James Burgess; H. M. Cadell; C. G. Cash; Dr. Th. Delius; Dr. G. Dods; Dr. Felkin; H. B. Finlay; Professor P. Geddes; D. P. Heatley; Professor C. G. Knott; J. W. M'Crindle; D. MacRitchie; R. C. Mossman; T. R. Munro; Ralph Richardson; C. Robertson; Colonel Sconce; A. R. Scott; Rev. S. J. Ramsay Sibbald; Dr. George Smith; Sheriff W. C. Smith; J. Arthur Thomson; Coutts Trotter; General Tweedie; W. B. Wilson.

Library and Map Department.

The accessions to the Library during the past session consisted of 276 books, 13 atlases, and 219 map-sheets. Five new exchanges have been arranged. The number of volumes borrowed by members was 2055, being greatly in excess of the number for the session 1895-96. The Library was also much resorted to by members and others in search of information. The sum spent on the Library, including the cost of binding, was £33, 5s. 7d.

The Council avails itself of this opportunity of recording its thanks to Foreign and Colonial Governments for the official publications presented to the Library, and also to private donors, among whom are the following:—Dr. Alex. Buchan; Dr. G. Dods; Professor H. Mohn; Mr. Stevenson; and Mr. Coutts Trotter. It also desires to acknowledge its obligation to the Corresponding Members of the Society, many of whom, besides contributing articles to the *Magazine*, have forwarded valuable books and pamphlets to the Library.

The Society's Rooms were closed for cleaning during the month of August.

Place-Names Committee.

In order to facilitate its work, this Committee nominated referees in different districts where the revision of the Ordnance Survey was being pushed forward. These referees, having much local knowledge and facilities for correcting local names on the survey maps, forwarded lists of suggested corrections, and the Director-General has reported to the Committee in the following terms, which will indicate the results thus far attained:—

Caithness (partly Highland, partly Lowland).—Seventy-nine suggestions. About three-fourths of them adopted.

Sutherland (Highland).—This county was specially dealt with. A Gaelic-speaking assistant of the Survey visited the principal districts of the county, and ascertained, as far as possible, the local usage. He afterwards conferred with the Rev. Dr. Joass, Golspie, who was one of the referees named by the Place-Names Committee of the Royal Scottish Geographical Society. The names of the houses or inhabited places or shooting tenancies were also tested by the valuation roll, and were as a rule submitted to the factors on the Sutherland estate. All changes thus authorised have been carried out.

It has been impossible to carry out changes suggested by some of the referees in the direction of spelling in the Gaelic form names which have been anglicised as applying to well-known mountains, or deer-forests, or inhabited places. But the Gaelic names of natural features have generally been retained.

Ross and *Cromarty* (Highland) and *Elgin* and *Nairn*.—The referees named by the Royal Scottish Geographical Society made no suggestions as to the place-names of these counties.

Inverness-shire (Highland).—For the northern part of the county the referees made a number of suggestions as to the names, of which about twelve out of every thirteen were adopted.

The corrections made here were very valuable. Two of the referees know the district well, and pointed out cases in which the Gaelic names, as formerly written to natural features on the maps, although they were grammatically correct, represented meanings different from the real meanings as known personally to the referee himself. All such corrections were, of course, at once adopted. The suggestions as to anglicised names were few in number, and some of these could not be adopted.

Western Islands and *Lewis* (Highland).—Only one referee agreed to act. Fifty-two out of the fifty-three suggestions made by him have been adopted.

Banffshire (partly Highland).—The referee made sixteen suggestions, all adopted.

Aberdeenshire, West (partly Highland, but all now English-speaking).—The referee made a large number of suggestions. Eighteen out of every nineteen have been adopted (182 out of 193).

Aberdeenshire, East (Lowland).—No referee having been named, two local gentlemen were consulted, Mr. J. Sleigh, Strichen, and Mr. John Rae, Ellon. About half of their suggestions were adopted.

Forfar and *Kincardineshire* (Lowland).—The referee (J. A. Campbell of Stracathro, LL.D., M.P.) named by the Royal Scottish Geographical Society was unable to answer for most of the county, but was good enough to name seven other gentlemen acquainted with the different districts. The latter have made 128 suggestions, of which 123 have been adopted.

Perthshire (mainly Highland).—Two of the referees for this county declined to act. One named another authority, who has been consulted and has made a large number of suggestions, about half of which have been adopted. It is, however, believed that a large number of names in this county are still written incorrectly or in corrupt form, as most or much of it is now English-speaking.

The second referee who sent a reply made some suggestions, of which most were adopted.

Argyllshire (Highland).—The principal referee for this county has made no reply or suggestions.

North Argyllshire and *South Inverness-shire* (Highland).—The referee made a few suggestions, but as most of them applied to names of inhabited places, only about a third could be adopted.

Buteshire.—The referee has made very few suggestions; some of these have been adopted for the 1-inch map, and all of them for the 25-inch maps.

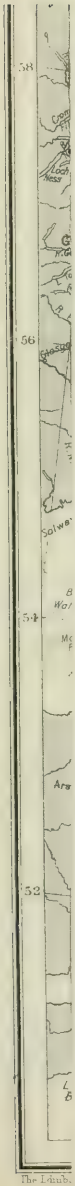
Notes.—In some cases suggestions made by the referees could not be adopted for want of room on the maps.

In some cases referees made observations explanatory of the meaning of names of Gaelic origin, without actually recommending that a change should be made in the form of the name as written on the maps. In these cases the names have not been changed.

The Council records its appreciation of the valuable services of the gentlemen who kindly consented to act as referees.

The Society's Branches.

The Council has again the pleasure to acknowledge the services rendered by the Honorary Officials of the Branches at Glasgow, Dundee, and Aberdeen.



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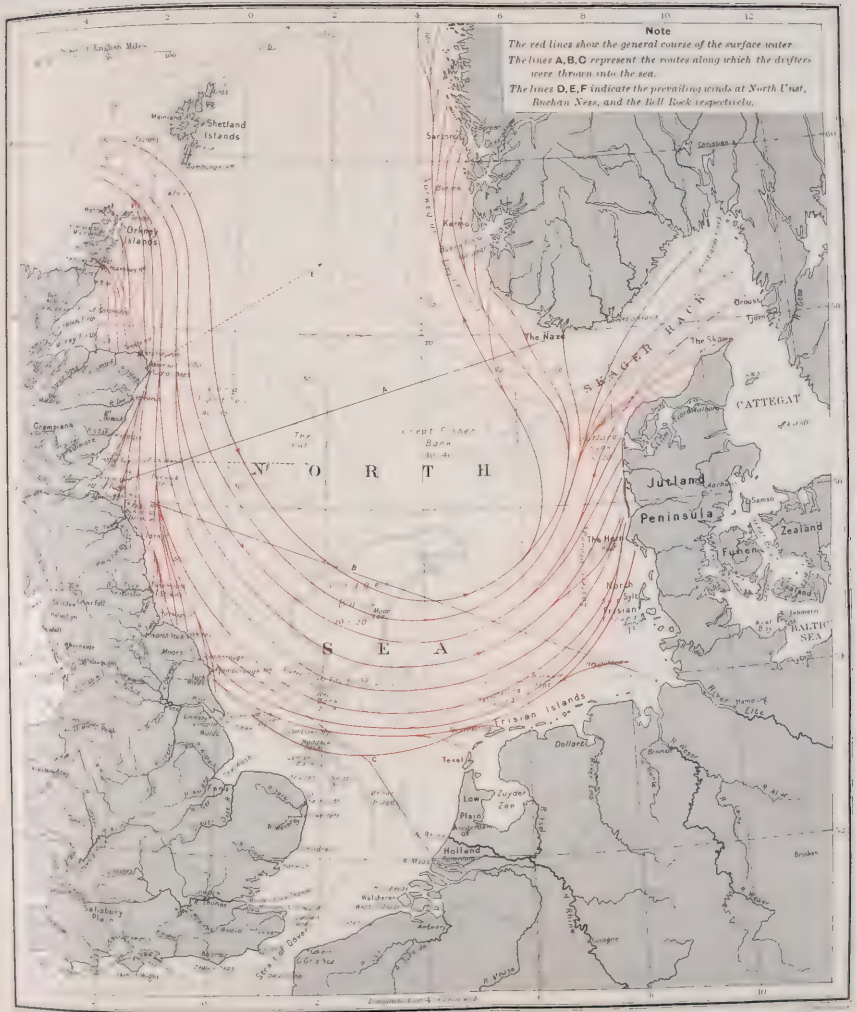
AFTER DR FULTON'S INVESTIGATIONS



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